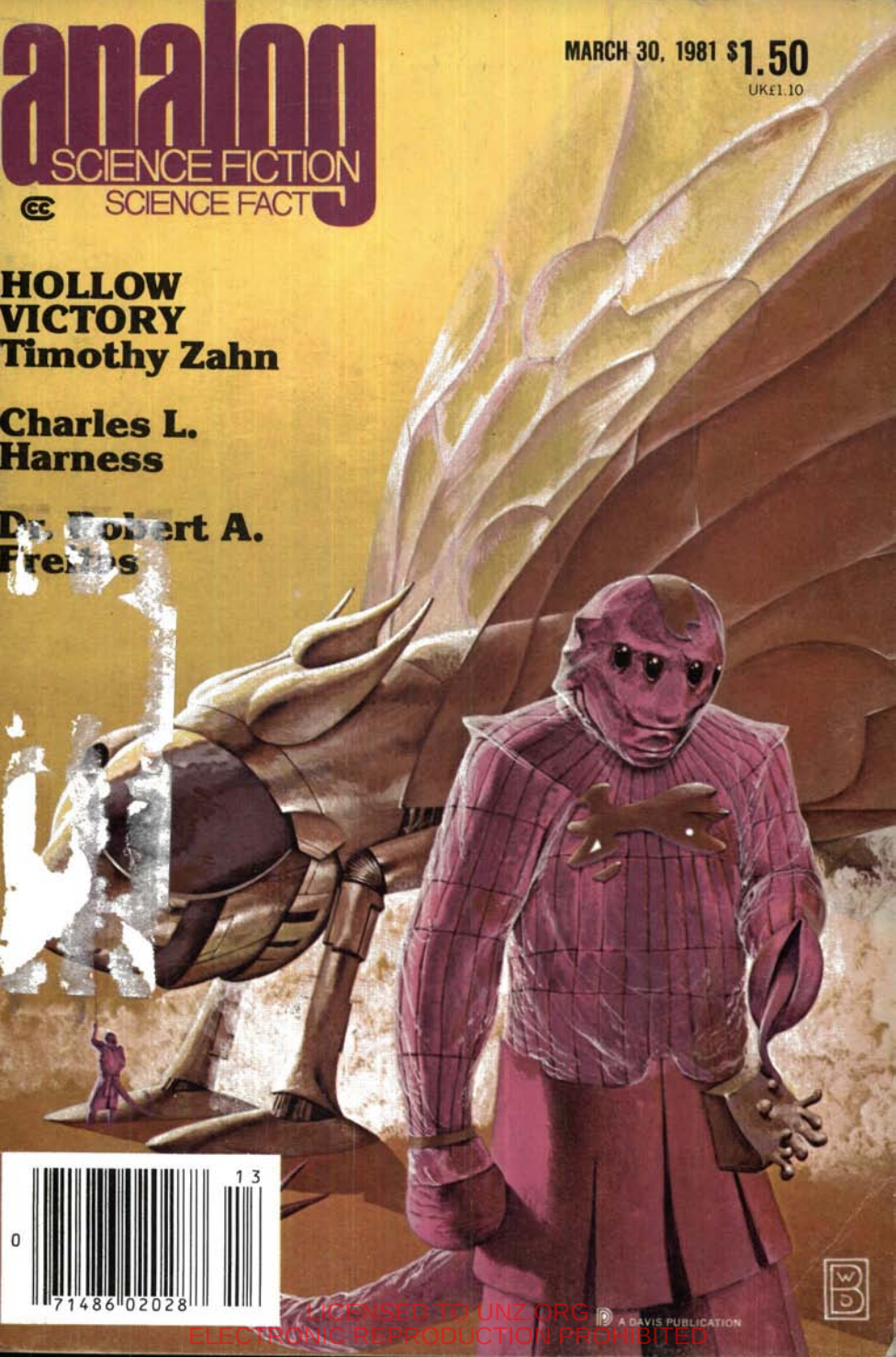

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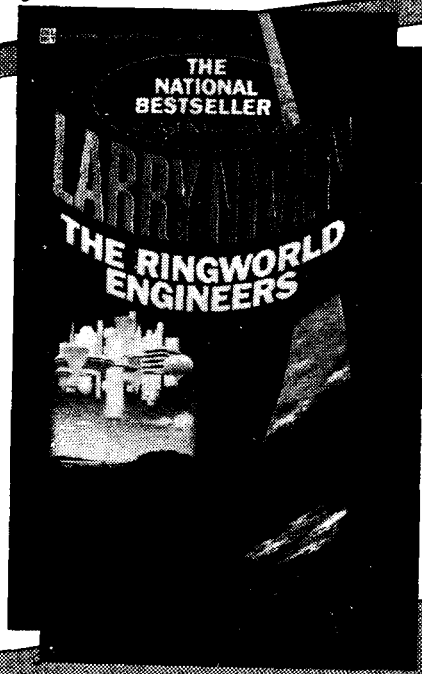

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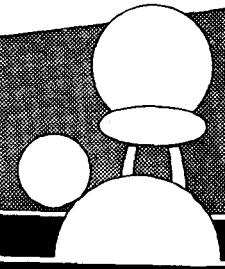

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EDITORIAL

ONE STEP AT A TIME?

By Stanley Schmidt

One of the most profound and useful realizations I ever made (and please note that *realization* goes beyond *intellectual awareness*) is that it's possible to complete very large projects by taking a succession of small, relatively painless steps. To a young writer, for example, completing a full-length novel may seem such an awesome task that he can't actually conceive of himself doing it—until he realizes that if he will just write a thousand words a day, he can be finished in two months.

And a thousand words isn't very much.

The same principle applies to virtually any long-range project, from overhauling a motorcycle or embroidering a pillowcase, to building a house, planning a research program, or reorganizing an entire civilization. However, the *nature* of the appropriate small steps is not always obvious—because if the

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project is big enough, it may involve changing many interrelated variables. Changing one part of a big, complicated system, without simultaneously making compensating changes in others, may be disastrous.

Suppose, for example, we concentrate on lengthening human lifespans by every means possible—cancer cures, safety measures that make accidents impossible, etc.—without also thinking about what to do about overpopulation. Eliminating disease and accidents is "obviously" desirable—but famine is not. Without care, one may bring on the other—but it doesn't have to, provided you concurrently think of a palatable way to reduce birth rates.

In other words, while many big jobs can be tackled one step at a time, sometimes it's better to take *two* steps at a time.

Or even more.

A particularly interesting, important, and timely example concerns a pair of problems which are currently very much in the public mind. One is unemployment—in particular, technological unemployment. Automatic machinery has long been making certain kinds of labor unnecessary; a recently released and widely publicized study predicts that the present rapid growth of computer use will eliminate huge numbers of additional jobs in the next few years. (Which is hardly earth-shaking news to anyone reading this magazine.)

The other current problem I'm thinking of is the depletion of natural resources such as fossil fuels (such as natural gas and petroleum) and raw materials (such as copper, silver, and petroleum).

One of the traditional solutions to the "problem" of keeping people employed has been to create jobs by dreaming up extra work projects—projects done not because of a perceived need for their end product, but because of a perceived need for tasks for people to do. Another is "planned obsolescence," the peculiar practice of deliberately designing products to fall apart in a short time, or to be thrown away after one use, so that people can be kept busy making replacements.

—Thereby using up scads of energy and materials—which we are finally beginning to view as exhaustible—for the sole purpose of keeping people busy doing jobs that don't need to be done, because our society is geared to viewing employment as an intrinsic good!

I hope you see the irony in that. We try to fix the unemployment problem by patching it—with material whose loss enlarges the resource problem.

This can't go on forever.

Let's consider something a little farther out: try to solve *both problems at once*, letting them partially solve each other. After all, they really deal with aspects of the same system—so let's look at the *whole* system and try to optimize that, instead of concentrating on one artificially isolated piece of it and tinkering with that while trying not to think about what havoc we may be wreaking elsewhere. If we do that, it just may be that at least one of our "problems" will wind up looking more like an unprecedented *opportunity*.

Key observation: a social system is a tool. A very complex tool, with social

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and political and economic parts as inextricably interconnected and interacting as the electrical and fuel and other systems of an automobile, but nonetheless an instrument used by the inhabitants of a culture to do certain jobs for them. It may do those jobs well or poorly; probably most real cultures have both helped and harmed their inhabitants in different ways.

Like any other tool, a social system *can wear out, break down, or be unsuited* to new jobs. You may be able to drive nails with a crescent wrench, but a hammer works a lot better.

If an axe gets dull or the handle breaks, you can sharpen or patch it—up to a point. But if the blade is really badly nicked and rusted, you may do better to buy a new axe—or something else entirely, if your needs have changed. If all your local trees have been cut down and you now buy finished lumber from a lumberyard, you'll have little use for an axe—but a lot for a band saw. If you're developing brand new materials and construction methods, you'll need new tools to go with them.

Social systems can be viewed in a somewhat similar way, and it might help if more of us realized that. If our old system has grown crotchety and inefficient, trying to patch it here and there might be far less productive than thinking about what kind we'd really like to have—about what kinds of social systems might best serve our present and future needs—*without* too many *a priori* constraints that say we must try to change just one or two things.

And then, having decided that, we can consider the second question: how might those systems be brought into being?

For now, let's consider only the first question, in regard to the unemployment and resource depletion problems: what kind of system might better serve the *total* needs of the people? Let's try to imagine one off-the-cuff possibility—and the first thing we must do is to carefully *define* those needs.

For starters, let's *not* consider a *certain amount of work an intrinsic good.* Let's even grant that more time to enjoy the fruits of labor might be at least as valuable—if you're willing to change several variables at once. Our basic needs, really, are to get certain tasks done—such as feeding, housing, and transporting people—and it now appears prudent to achieve those tasks with minimal consumption of resources. There may be additional constraints we'd want to add, but for now let's just look at how we're doing on those two.

Our present throwaway economy flagrantly violates the second requirement (low consumption) to achieve what might be considered overkill on the first. (When large numbers of people are making things which nobody really needs, or making three things to do what could be done by one, we might well suspect that there is not enough "legitimate" work to go around, i.e., to fill the number of person-hours being used.) Suppose we tried instead a system that reincorporated what was once considered a virtue: building things of such high quality that they don't need to be replaced very often. This would cut down the wasteful consumption of ma-

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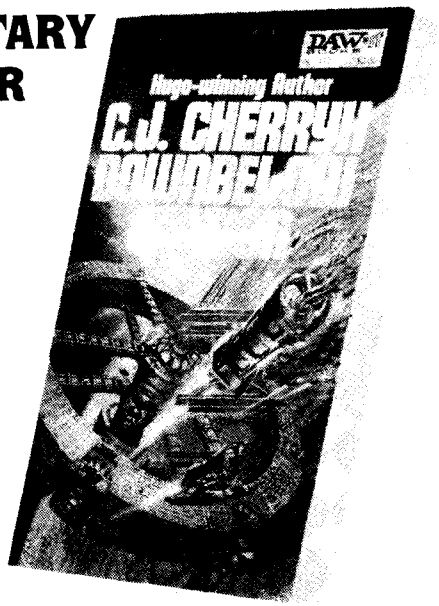

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terials and energy—but it would also mean less work to be done. The traditional answer to this would be anguish over an "unemployment crisis," with some people having no work to do while others continue more or less as they were.

But is "less work" a problem or an opportunity?

Suppose the necessary work is *redistributed*, with everybody doing some of it—but not as much as before. Then everybody has a share of the burden, everybody is doing something to justify an income—and everybody has more time to enjoy what can be done with that income, and to pursue work *beyond* the necessities, such as exploring the vast potentialities of the human mind and the rest of the universe.

Why aren't we already doing something like that? Actually, there have been small steps in that direction, such as a gradual trend toward shorter work weeks. But the trend seems rather halting and haphazard. This is, I think, at least partly because we are still hampered by the "one step at a time" syndrome. We continue to view unemployment as a self-contained, independent problem (which it isn't) and a certain amount of employment by each individual (rather than getting the society's needed work done) as an intrinsic and unchangeable good. We keep looking for something we can change without simultaneously changing that attitude. A change in that attitude is, in fact, a radical one, and, as with any radical change, it's probably a good idea to approach it with some caution. But I suggest that we would do well to consider that the popular dichotomies (such as "Puritan work ethic" versus "rampant hedonism") do not really exhaust the possibilities. For example, I personally currently think we badly need a "work ethic," in the sense of a citizenry devoted to doing *well* whatever work they do—but I see no intrinsic virtue whatsoever in a human being's putting in toil for toil's sake after he and his are comfortably fed, clothed, and housed. If we can achieve a decent standard of living with x amount of work, what merit can there be in doing $2x$ for the same result?

Such a change in outlook and practice is radical in at least one other respect, of course—and this is the one that would make it hard to achieve, even if everyone agreed that it was desirable. It requires *coordinated* changes, at a rather fundamental level, in not just one or two, but in *many* of the things we do. The key question is how you can bring about that far-reaching a change in a smooth enough way that the side effects of the transition aren't too unpalatable. The system *can* be left to adjust itself; it will, but various segments will try to change in ways that seem to fit their own immediate needs, and some will be more successful than others at this. It's hard to foresee what the net change in the overall culture will be—but it may not be optimum, by anybody's definition. If, on the other hand, you try to force the whole system in a predetermined direction, that seems to require a degree of official regulation that is, at best, unattractive.

It's a difficult dilemma, but one worth considerable effort to solve. It's

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time, I submit, for us to develop an "art of change," *per se*.

One final observation: often, in discussing the kind of possibility I've been discussing here, I've heard the objection, "Most people couldn't handle all that free time. They wouldn't know what to do with themselves." I concede that this is a problem, hard though I suspect it is for most of you to imagine having it yourselves. I *don't* concede that it's an insoluble problem. When we consider how few people have had the chance to *have* the problem of what to do with a lot of free time—and the guilt feelings they've been conditioned to associate with it—is it any wonder that many are not very sure how to solve it? The assumption that most people can't *learn* to make good use of free time seems premature and unduly cynical. It reminds me, in fact, of those people in the early days of printing who asserted confidently that "the masses" just *couldn't* be taught to read.

And look how wrong *they* were. ■

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HOLLOW VICTORY

"Normality" is a matter of adaptation—
and too perfect an adaptation
to one set of circumstances may be
a distinct handicap in another.

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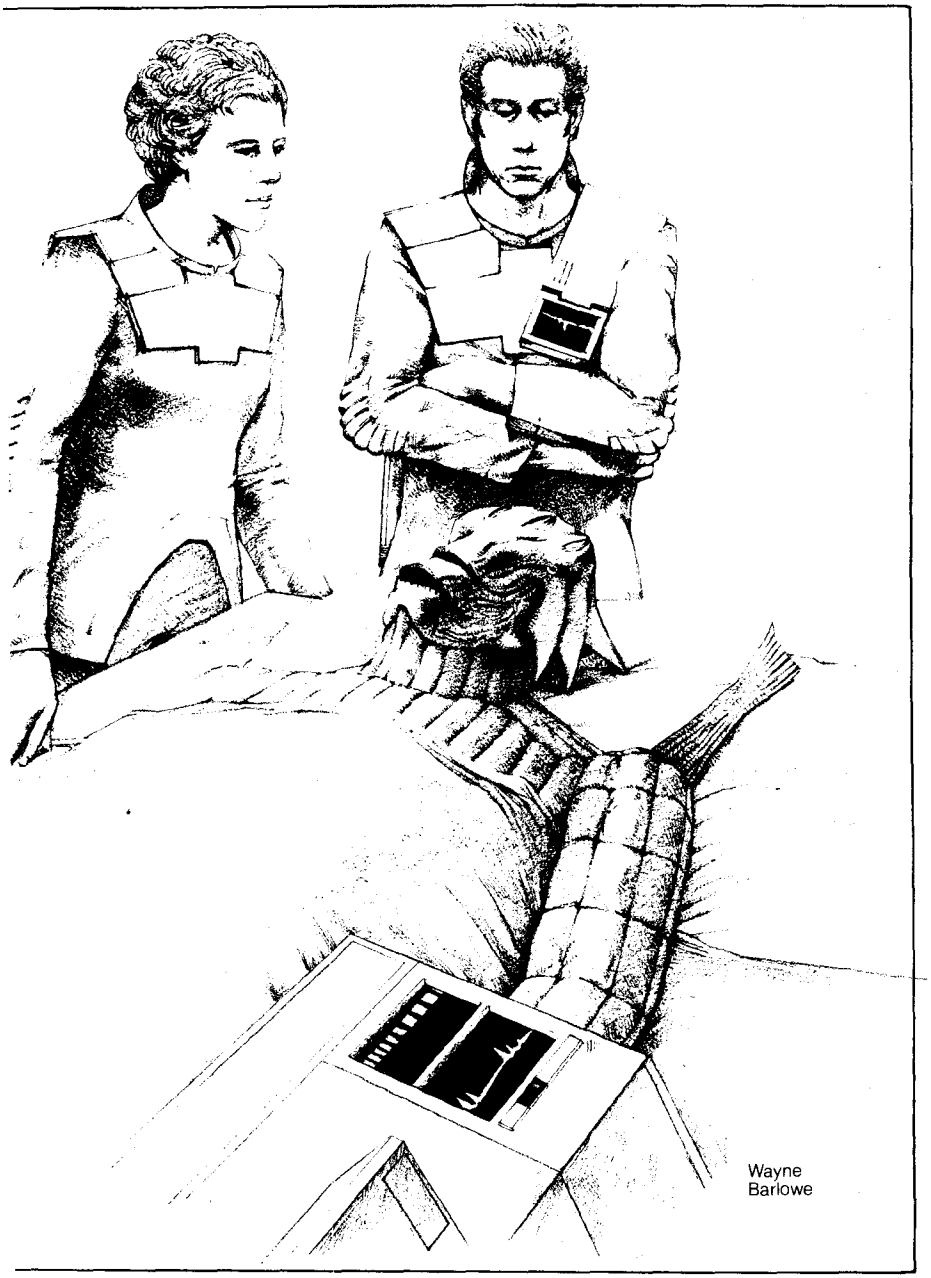

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The Thrulmod spacecraft looked more like a giant insect than anything else as it crouched in the center of the glassy, fused-sand landing area. Its huge gliding wings were still extended and the six landing legs were positioned and shaped much as a housefly's would be. The four huge Terra Command ships which had escorted it were arrayed in a rough square around it. From the cluster of buildings a kilometer away a small stream of vehicles approached.

On a fifth-floor balcony of the tallest of those buildings Dr. Kenton Langly peered through a set of binoculars at the alien ship, trying not to blink. He had only been on the planet for six hours and his eyes still showed a tendency to water in the unfamiliar red-orange 61 Cygni sunlight. "The landing wings are starting to retract," he announced.

The woman at his side did not comment. Without looking, Kenton could sense the stiffness of her back, the hard set of her mouth. She had been angry since their first meeting three hours ago, and his gently insistent suggestion that she watch the landing with him had certainly not improved matters. But whatever the problem was, it needed to be straightened out, and Kenton preferred having his confrontations in private. "Dr. Rolland," he said, eyes still on the alien ship, "if we're going to work efficiently together, we're going to have to communicate. I'd like to know what's bothering you."

Dr. Anne Rolland shook her head. "It's nothing important, Dr. Langly. It won't interfere with our work."

"Sorry, but that won't do." Kenton turned to face her. "I need to be able to talk with my co-workers without risking frostbite—it's a quirk I have. If it's me personally you can't stand I can probably get Kertesz to call someone else in as medical observer."

"Observer!" she snorted. "Boss, you mean. It's always the same: Earth gives the orders, lets the Protectorate work its collective tail off, and then sends in a whole raft of high-level Centrum bureaucrats to take over. I realize that we're a small planet and that this is an important project, but if we were competent enough to get the ball rolling, we should be competent enough to keep going with it. And if not, where were all you birds when we were trying to get everything set up in time? We could have used a lot more personnel and money."

"Well, technically. . . ." Kenton stopped; Anne was in no mood to hear the point he'd been about to raise. But she was already ahead of him.

"Yes, I know: technically, Cygni is still a Protectorate, and therefore its resources and people are legally Earth's anyway—and that's adding injury to insult. You probably don't know it, but we were ready to apply for Autonomous World status last year. But this Thrulmod thing is straining our economy so much that we probably won't be ready again for a couple of years." She slammed her hand down on the balcony railing.

Kenton nodded to himself; he had half-suspected this was the real trouble. The desire of colonies for freedom was as strong now as it had been on the mother world for centuries. True freedom was impossible, of course; the Terran Alliance bordered both the Valtian and Seslian empires, and it was only

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mankind's uncommitted strength which had kept those two deadly enemies from each other's throats for the past century. The differences between Protectorate and Autonomous World were thus largely symbolic and psychological—and yet the change in status, Kenton had found, was vitally important to nearly all Protectorates. He didn't entirely understand it; but, then, he *was* from Earth.

"I understand your anger," he said cautiously, "but, frankly, I think that the good job Cygni's done here will be far more impressive to the Centrum than any economic statistics. Remember the boost in prestige TriStar got after the Dorian War two hundred years ago. The situation here is pretty similar."

That aspect had apparently not occurred to her, Kenton noted. She nodded slowly, almost grudgingly, some of the tension lines disappearing from her face.

"And, just for the record," he continued, "while Ambassador Kertesz may be here to take over the talks, *I* am not here to take over anything. My job is exactly as advertised—to observe things and give any help that *you,* the ET biomedic in charge, choose to ask me for. You've got a damn good setup here; as far as I'm concerned this is your show. Clear?"

"Clear." She still sounded only half convinced, but that was all Kenton needed for now. His actions should do the rest.

Anne squinted at the Thrulmod ship. "The airlock's opening."

Kenton turned back toward the landing area and studied one of the creatures emerging from the alien ship. It was a biped, shorter and stockier than a human, with a covering of armor-like plating that made it resemble a pile of violet bricks. The thick tail, similarly armored, was nearly two meters long and ended in three short spikes. The four eyes, sunk deeply into the skull, were protected by heavy brow ridges. The arms ended in clamshell-like appendages, with no fingers or other grasping members visible. It wore a kilt of some shiny material and a transparent full-body sheath, the latter probably for protection against alien microbes while outside the buildings.

"Well, what do you think?" Anne asked.

"Professionally or personally?"

She considered. "Personally."

"Ugly."

The faintest hint of a smile touched her lips. "Better try professionally, then."

Kenton smiled back. "Their planet is a bit heavier than this one, I would guess—they're showing a tendency to bounce. Cranium is big enough to hold a good-sized brain. Eye positioning should give a two-hundred-degree field of view. Not much else I can tell with all that natural armor." He lowered the glasses. "Let's get downstairs before they come in. I want to see close up what Thrulmodi use for fingers."

The first explorers to the double star Krüger 60 had found that the second planet of the brighter star could, with some terraforming, be made habitable for humans. Accordingly, the next expedition to the system had carried a full complement of scientific personnel to make the necessary studies, and the world Krüger 60-A-II came officially

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under the aegis of the Terran Alliance. For some unknown reason neither expedition got around to checking out the Krüger 60-B system, only a few billion kilometers distant.

It came as a distinct shock, therefore, when spacecraft from that system appeared over the human base. Whether or not the Thrulmodi—as they called themselves—had known of the interlopers in advance was still not known; nevertheless, their fleet was highly military in make-up and had little trouble breaking Krüger Base's light defenses. One human ship got out, though, and ten days later Admiral Arnell and half of the Terra Command Fifth Fleet were in orbit around Krüger Base, loaded for bear. The Thrulmodi had in the meantime secured their position and were holding the base personnel hostage.

It shouldn't have been a stalemate, of course. With a technology two centuries behind Earth's, the Thrulmodi stood no chance whatsoever against Arnell's squadron, and a simple threat to bomb the Thrulmod home world back to its equivalent of the stone age would probably have freed both the hostages and the base. But political considerations ruled out that approach and so, in the best traditions of human diplomacy, the Thrulmodi occupying Krüger Base had been invited to a meeting on Earth to discuss the matter. The aliens had agreed to a meeting, but had flatly refused to ride any human ship, and had furthermore refused to move the talks to either Krüger Base or their own home world.

Negotiators had seen this as a delaying tactic, since without the Torque-shift device the Thrulmod ships could not enter hyperspace and would thus take decades for the four-parsec trip to Earth. Terra Command had proved equal to the challenge, however, by detailing four of their big Nova-class starships to magnetically *carry* the ambassadorial craft through hyperspace to the meeting. The site was quickly changed from Earth to the Cygni Protectorate, the only human world within easy reach of this piggyback maneuver, and work was frantically begun to prepare for the v[illegible].

Thus it was that, seven months after the Thrulmod invasion of Krüger Base, Drs. Kenton Langly and Anne Rolland stood among the assembled dignitaries as Special Envoy Kertesz welcomed the eight alien delegates to human space.

". . . We of the Terran Alliance wish only friendship with the beings of the Thrulmod system, and are certain that any and all differences of opinion and intent can be settled in a peaceful manner . . ." As Kertesz spoke, Kenton took the opportunity to study the aliens more closely.

The arms were somewhat longer than those of a human, he noted, and the legs were shorter. The feet were four-toed, the fourth pointing backwards, and were large and thick. The heavily plated head was connected without a discernible neck to the barrel-like torso. The long tail, which curved first down to touch the floor and then back up to waist height, provided balance while walking and part of a three-point stance while standing. It also looked to be useful as a weapon. Twin gashes underneath the four eyes apparently served as mouths—one for eating, the other for speaking, Kenton later learned. The

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Thrulmod grasping members were more like tentacles than fingers and were kept coiled up inside the clamshell "hands" when not in use. All the Thrulmodi wore headsets linking them to the computer complex acting as translator.

Kertesz finished his speech and there was a short pause as the computer finished its translation for the aliens. Then one of the Thrulmodi stepped forward, slapped his tail twice on the floor, and began hissing through his upper mouth. Presently the "tattle-tale" in Kenton's right ear came to life.

"We accept your welcome; I, Ambassador of the Thrulmodi, accept it. We reject your friendship; I, Ambassador of the Thrulmodi, reject it until you reject your invasion of Thrulmod territory. Such matters will be spoken of tomorrow. We now wish to examine our place-of-resting."

The Thrulmod slapped his tail once and stepped back. Kertesz bowed and gestured to a man wearing the uniform of a Terra Command flag officer. "Commodore Southern, my staff coordinator, is at your service. He will show you to your suite. We trust you will find the rooms comfortable."

A great start, Kenton thought bleakly as Southern led the aliens away. If the Thrulmod position was as unyielding as their Ambassador had sounded, it might well be years before any agreement could be reached.

Pushing such thoughts from his mind, Kenton spent a few minutes talking with various diplomats and was about to leave the hall when he was intercepted by a small man in a civilian tunic. "Excuse me, Dr. Langly," he said. "I've got something here you should look at."

"Thanks, Charlie." Kenton scanned the sheet of paper handed him and almost choked. "Where were these radiation levels measured?" he asked as calmly as possible.

"Near the Thrulmod ship, at the distances indicated."

"What's the damn thing made of, thorium?"

"No, but you're close. The radiation seems to be coming from an old-fashioned atomic pile on board, probably a breeder-type reactor. They don't seem to have any fusion devices aboard their ship."

"That pile has lousy shielding," Kenton muttered, still studying the numbers. "But I suppose that explains why they want Krüger Base so badly. There are a hundred places on that planet just loaded with radioactives. If they really don't have cold fusion I imagine the Thrulmodi can use all the uranium they can get. Have you told Dr. Rolland about this?"

Charlie nodded. "Yeah, a few minutes ago. She's gone to the medical wing, if you want her. Said something about scaring up a few hundred dosimeters."

"Good." Everybody working near that ship would need to be protected by careful monitoring. In addition, everything the aliens had brought in with them should be checked for neutron-induced radioactivity, just in case. "Can you put up some warning lights, too?"

"I've already got some men on that, Doctor, and I'd better be getting back there myself. See you." Charlie moved off.

Kenton scratched his chin thought-

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fully. He had intended to go to his quarters and get a good night's sleep before the negotiations—and any major medical work—began in earnest, but this news changed things. Leaving the room, he headed for the medical wing.

Anne Rolland was hunched over a pile of computer prints when Kenton found her. Glancing up, she said by way of greeting, "Did you talk to Charlie Evans?"

He nodded. "Will you be able to get all the dosimeters we'll need?"

"I've sent out priority requisitions all over the planet. We'll see what we can get." She indicated the papers before her. "The preliminary EM scans of the Thrulmodi are finished. Take a look."

Kenton studied the pages briefly. The electromagnetic sensor-probe, a sophisticated multiple-frequency projector/scanner using wavelengths from microwave to x-ray, was the standard investigative tool for a host of scientific disciplines, and ET biomedicine was no exception. Even a fast, informal probe with the device usually provided a wealth of useful information, and this time was no exception.

Thrulmod chemistry was based on oxygen, carbon, hydrogen, and nitrogen and included a wide range of trace elements as well. The cellular structure was similar to man's, though the details of its chemistry were still unknown. The violet armor plates were composed of the same material as the bones and the tail spikes. Though the internal arrangement of the torso was radically non-human, the individual organs could be easily distinguished, and several had been tentatively identified.

"Looks good," Kenton commented, straightening. "We'll have to make specific arrangements with the Thrulmodi to get more detailed scans. Where are these probes located, by the way?"

"In the hall leading to their suite," Anne said. "I'll talk to their doctor tomorrow about more thorough examinations. We should have some pretty complete data on Thrulmod physiology by the end of the week."

That prediction, unfortunately, proved overly optimistic. The Thrulmodi flatly refused to submit to examinations of any sort.

"It's apparently beneath their dignity to be studied by humans," Anne explained angrily to Kenton after finally giving up.

"Well, don't forget we're the first aliens they've ever met," Kenton pointed out cautiously. "Maybe you could offer to let their doctor take the readings for us; EM probes aren't that hard to use."

"I *did* suggest that. I also offered to let him study some human volunteers in exchange. He didn't want to touch our machines and said human physiology was a matter of complete indifference to him."

"Hmm. Is there any way you could install some equipment in their suite and take readings without their knowledge, like the way you took those preliminary EM scans?"

"Sure, lots of ways," she snapped. "Only your friend Kertesz won't let us. He came here two weeks ago clucking about privacy and dignity and made us pull out all the stuff we had in the suite. All we've got left are the things we could put completely outside the rooms—atmosphere and excretion ana-

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lyzers, which won't tell us much more than the hallway probes already have—and the floor sensors Security put in to keep track of them."

And *that*, Kenton decided, must be why he was suddenly getting more of the iceberg treatment today. Guilt by association. But there was nothing he could do; on this sort of mission the chief negotiator's word was as good as law. "Well, we'll just have to make do, then."

Anne snorted. "And we'd better hope none of the Thrulmodi come down with any sickness their doctor can't handle. With the data we've got I couldn't even prescribe a headache cure."

"Don't even think things like that."

The negotiations were in their fifth week when the Thrulmod ambassador's personal aide suddenly stopped attending the daily sessions and secluded himself in his room. Two days later Kenton was dragged out of bed in the middle of the night by an urgent summons to the medical wing. He arrived there to find Anne and her staff in a state of controlled chaos.

"Something's wrong with the aide," Anne told Kenton as he joined her before a computer display. She tapped a number on the viewscreen. "His excretion level has shot up eight hundred percent in the last hour, and it's still climbing."

Kenton came wide awake. "What's his food intake been lately?"

"He hasn't eaten all day, though he's stepped up his water intake. But here's the real kicker: over ninety percent of the waste matter seems to be torn-up Thrulmod cell material."

"Blood or tissue?"

"Both, we think, but it's hard to say. Our cellular data isn't nearly complete enough."

Kenton nodded grimly. "What are the other Thrulmodi doing for him?"

"Nothing. Security's floor sensors indicate that everyone's still in his own room of the suite. The aide himself hasn't tried to call for help, though he can still move about." She waved, half-angrily, in the general direction of the computer displays. "*That* I don't understand. He's lost nearly five percent of his body weight already and shouldn't even be conscious, much less walking around."

Kenton scratched his chin, conscious of the stubble there. "Have you talked to Kertesz about sending a medical team in?"

She snorted. "He wants us to wait a few hours, lest we violate some taboo, or something."

"Well, since the Thrulmodi themselves don't seem overly worried, Kertesz may be right."

"Dr. Langly, that aide may be *dying!*"

"I fervently hope not, but we'll just have to wait and see."

Nearly four tense hours passed before the abnormal excretion rate began to decline, reaching its usual level soon after that. A call to the Security duty officer confirmed that the aide was still mobile—and therefore still alive—and Anne sent her tired staffers back to their rooms for a few hours' sleep.

Kenton left with them. The full results of the night's collection of data wouldn't be ready before morning, and in the meantime he had some hard thinking to do. It was time, he decided, for

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his first face-to-face talk with a Thrulmod.

"That's him now," Anne said, pointing at one of the violet-plated aliens emerging from the Thrulmod wing.

To Kenton they still all looked alike, but he was willing to take Anne's word for it. Together they moved forward, and Kenton touched a switch on his throat mike. "Doctor, I am a medical observer," he said, using the words and phrases that experience had showed were most easily translated. "I wish to speak to you if the time is acceptable."

The alien stood motionless until the computer translation was completed. Then his upper mouth began to move. "The time is acceptable," Kenton's tattle-tale whispered. "Speak as you will, Observer."

"The aide to your ambassador has not left your place-of-resting in nearly three days. We are concerned for his health."

"Such matters are not your concern. I and my medical assistant will treat any illness which may arise."

"But is it not possible that a Thrulmod illness may be transmitted to one or more humans?" Kenton asked carefully. "In such a case our doctor—" he indicated Anne "—would need to know about the illness to properly treat it."

The Thrulmod stood motionless for several seconds, then twitched the tip of his tail. "Very well. I think you are aware of the aide's condition?"

"We have a small amount of such knowledge." Kenton's statement seemed to shock Anne, but since the doctor clearly already suspected the presence of monitoring devices, Kenton saw no real harm in tacitly confirming his guess. As politically adroit as the Thrulmodi had proved themselves to be, the concept of an open secret would certainly be one they understood.

"This condition is attained at intervals by each of us and is called the Rebirth," the doctor said. "It is a time of cleansing of mind and body. Rebirth is not an illness, but a destroyer of illnesses. It poses no threat to humans. That is all you need to know."

"How often does Rebirth occur?" Anne asked.

"That is all you need to know," the Thrulmod repeated. "The time for speech is now ended." He slapped his tail once on the floor and walked away.

Anne stared after him, obviously too deep in thought to be irritated by the alien's reticence. Kenton took her arm and steered her toward the medical wing.

"Do you suppose he's telling the truth?" she asked as they walked.

Kenton remembered to turn off his throat mike before answering. "As far as I know, no one's ever caught a Thrulmod in a direct lie. The doctor's explanation fits the known facts, at least."

"It's a fascinating idea," Anne mused. "Like a snake shedding its skin, but on a far more complex scale." Kenton's noncommittal answer to her question suddenly seemed to penetrate. "Don't you believe him?"

Kenton shrugged. "For the moment I'll assume he was being honest. But I'm keeping an open mind."

She snorted. "Cynic."

"Part of the job—for both of us."

She snorted again, and they finished

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the trip in silence.

At dawn the next morning, and after nearly ten hours of non-stop eating, the aide was back at the ambassador's side for the daily bargaining session. He appeared completely healthy.

Negotiations with the Thrulmodi crawled at a footsore snail's pace for what seemed like a good approximation of eternity. Despite the ever-increasing mound of linguistic data in the translation computer, communication still broke down occasionally, usually at the most awkward times. In addition, the aliens were as patient as their demands were unyielding, and were clearly willing to spend years at their task if necessary.

Life in the medical wing had settled down to a comfortable, if boring, routine as well. The data from the first probes had been long since squeezed for all they were worth by the computers and the results were being studied by various of Anne's specialists. The expected radiation hazard had never materialized, but a careful watch was maintained on the five hundred dosimeters in the complex. Other than that, there was little work to do.

Then, in the thirteenth week of negotiations, the routine was broken. The Thrulmod ambassador abruptly canceled his daily meetings with Kertesz and closeted himself in his quarters. For a week the medical staff waited in anticipation of another Rebirth, but the expected changes never happened. Even more ominous was the fact that neither the doctor nor the medical assistant had left the suite since the ambassador's disappearance.

Shortly before noon on the tenth day Kenton was summoned to the diplomatic wing for an urgent meeting with Kertesz, Commodore Southern, and Anne Rolland.

"I'll come right to the point," Kertesz said after they were assembled in a plush conference room. "I spoke to the Thrulmod doctor this morning. The ambassador has come down with an unknown disease."

Kenton heard a sharp intake of breath from Anne, felt his own neck muscles tighten. Forcing calmness into his voice, he asked, "Is he asking for our help?"

"Not formally, no." Kertesz ran his fingers through his silver hair. "I gather he hasn't permission to do so. However, he seems vastly worried and might welcome an offer of assistance. Whether they could accept it without losing face is another matter." He turned to Southern. "Blair, what's the transport situation?"

The commodore frowned. "The four Novas we used to carry the alien ship are back on patrol with the Fifth and Seventh Fleets. The fastest ship I've got available here—the *Steinmetz*—could make Krüger 60 in four days or so and Earth in about twice that time. But if the Thrulmodi still won't ride on our ships, we'll have to send couriers to recall the Novas, and that could easily use up another couple of weeks."

Kertesz nodded slowly. "Then it's probably up to us here. At any rate, I doubt that sending him home with a possibly contagious disease would make us very popular with either government. Dr. Rolland, what's the first step?"

"If they want our help, Mr. Ambassador, they'll have to let us take full

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EM sensor-probe scans." Anne's voice was steady; she was taking this well, Kenton thought. "That is an absolute, rock-bottom condition. We can't possibly diagnose, let alone treat, without that data."

"I'll talk to their doctor right away," Kertesz said. "He refused that request before, but the circumstances are different now. What else?"

Anne considered, then shook her head. "Nothing else you can do. My staff will be ready whenever you get the doctor's okay."

Kertesz stood up, the others following suit. "Dr. Langly, I want you to act as liaison between Dr. Rolland and myself. Keep me informed on all developments."

The Thrulmod doctor was not only vastly worried, he was eminently practical. His talk with Kertesz lasted less than thirty minutes, and five minutes later he was in the medical wing learning to use a portable EM probe. He proved to be a quick study and was soon able to return to the ambassador's quarters with the device. Within an hour the process was complete, and by the time the doctor returned with the scanner the preliminary results were already beginning to emerge.

"Any chance of an error?" Kenton asked.

"None." Anne tapped the computer-drawn skiagraph in front of her. "Five major tumors and over forty minor ones.

"The ambassador has cancer."

The Thrulmod doctor listened in silence as Anne carefully described her findings. Then he blinked his leftmost eye. "This disease is unknown to our people."

Kenton frowned. "That seems strange. The radiations produced by your spaceship's power plant will cause cancer in our species. Surely you have some experience with these effects."

"Unless," Anne interjected suddenly, "this is your first use of fission power. Is it?"

The doctor considered, apparently decided it wasn't a state secret. "No, this has been our major source of energy for many years. It does not cause disease unless handled carelessly."

Kenton raised his eyebrows. Resistant to radiation sickness? No wonder they were willing to share a spacecraft with a fission reactor!

"You know this disease," the doctor continued. "I do not. You must cure the Ambassador."

"We'll do our best, but it'll take time," Anne said.

"Do not let it take too much time." He slapped his tail once and left.

Anne bit at her lower lip and sat down at her desk. Kenton sank into a chair next to her. "Well, look at the bright side," he said, just to break the silence. "If the Thrulmodi aren't affected much by radiation, then the x-ray component of our secret EM probes three months ago didn't cause this."

"Very comforting," Anne growled. "Now all we have to do is find out what did. And find a way to cure it."

"You suspect a carcinogen?"

"What else? Only, I would have sworn this building was absolutely free of anything dangerous. The air is so clean it squeaks—if we ran it through

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any more filters we'd have nothing but pure oxygen left. Same goes for the water. And as for food, the Thrulmodi are still working on their own supplies." She gestured helplessly.

"What about the furniture?" Kenton asked.

"Stainless steel and nonallergenic leatherite; same for the wall and floor coverings. No carcinogenic plastics anywhere."

"Except that what's carcinogenic for us may not be so for them, and vice versa."

"Especially vice versa."

"Right." Kenton scratched his chin. "Let's try a new approach. Which organs have been affected by the disease?"

She grimaced. "It's easier to say which ones *haven't* been." She indicated places on a skiagraph as she spoke. "The heart, genitalia, these three organs, and what appears to be the pituitary are untouched. So far."

Kenton leaned over the desk for a better look. "Is that interior wall the same material as the armor plating?"

Anne nodded. "You'll note that that gives the genitalia and those three organs an extra five centimeters of protection in places and almost seals them away from the lower part of the body cavity."

"Curious. What do those three do?"

"We don't know." She punched computer keys. "They're coded a Alpha, Beta, and Gamma, from left to right. All three are ductless glands, emptying directly into the bloodstream through rather twisted channels, but they seem to be inactive at the moment. The fluids inside are extremely complex chemically, but the molecular structures are still unclear."

"Hmm. Could it be genetic material of some sort? That might link the organs to the reproductive system."

"It's possible. The fluids are certainly complex enough. Speaking of which—" she poked some more buttons— "the first cellular biochemistry study is in now."

Kenton skimmed the report. Thrulmod cells looked and behaved much like their terrestrial counterparts, but the chemistry was radically different. The complex molecule that was the Thrulmod equivalent of DNA—it had been coded as ThNA for convenience—was, for example, shaped like a giant ring or disk, instead of the familiar double helix.

"I've got a group studying the ThNA," Anne said. "We're looking for differences between healthy and diseased cells."

"Good." The first effects of a carcinogen would be on that type of molecule. "If we can find a common flaw in the ThNA we may be able to pinpoint the cause."

She nodded. "For whatever good that'll do us toward finding a cure. We're also looking for trace elements in the healthy ThNA that might be missing from the environment here."

"Sounds like a reasonable start. What can I do to help?"

Anne hesitated. Three months ago, Kenton reflected, she would probably have told him to stay out of the way and to let her team operate without interference from Centrum desk-riders. But this wasn't three months ago. "I'd like you to act as a sort of free-lance, wan-

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dering around and watching everyone, and helping out or making suggestions where needed." She pursed her lips, then continued, "I'd also like your help in coordinating things. This is turning out to be a bigger job than I bargained for."

"I know how you feel," Kenton agreed. "But there are lots of us, and only one of it. We'll beat it yet." He wished he felt as confident as he sounded.

The next few days passed far too quickly, and although the mass of information on Thrulmod physiology grew rapidly, all of the crucial questions remained unanswered. The ThNA molecules had been extensively studied, but no common flaw had been found among the cancerous growths. Environmental factors were checked and rechecked, always with negative results. Signs of viral activity in the ambassador's cells were searched for, without success.

Then someone thought of checking the ambassador's healthy cells against those of the other Thrulmodi, with the hope of finding a natural interferon-type chemical that the Ambassador might be missing. The Thrulmodi weren't too keen on submitting to EM probes, but they were even less happy at the prospect of losing their ambassador, and in the end all seven were given the full examination. No interferon was found, but the results nonetheless caused Anne to call an immediate meeting with Kertesz, Southern, and Kenton.

"Six others have it," she announced to them. "The doctor, medical assistant, advisor, and the three spaceship crew members are all riddled with small tumors. They're too small to be dangerous yet, but it's just a matter of time."

Kertesz spotted the crucial fact first. "The aide is clean, Dr. Rolland?" he asked.

"Of course!" Kenton broke in before Anne could answer. "The Rebirth!"

Anne nodded. "Since the aide was the only alien to undergo Rebirth here, we're tentatively assuming that the Rebirth—or lack of it—is somehow tied in with the cancer."

"A cleansing of body and mind, the doctor called it," Kenton mused. "Do you suppose the ambassador is overdue for his?"

"That was my first thought, so I talked to the doctor again." She spread her hands helplessly. "The Rebirth comes at irregular intervals, even for a given individual. The Thrulmodi don't know what causes it, or even what happens during it. It's apparently a very private, almost religious experience and virtually no medical research has been done on it."

"When was the ambassador's last Rebirth?" Kertesz asked.

"I don't know. I've just told you everything the doctor told me, and it was like pulling teeth to get even that much." She paused, then continued. "The main reason I called this meeting is that I need some classified information. If the ambassador is indeed overdue for Rebirth, it might mean the environment here either lacks a necessary trigger or contains an inhibitor to the process. Either way, I need everything we've got on the Thrulmod home world. There's nothing in the general computer file, so I gather I need special clearance from you to get the data."

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Kertesz and Southern glanced at each other. "I'm sorry, Doctor, but we have no such information," the Commodore said quietly. "The Thrulmodi have consistently refused us permission to enter their system, and the political decision was made to respect their wishes."

"We don't even have flyby data?" Kenton asked.

Southern shook his head. "It was part of the Centrum's overall policy of restraint." He looked back at Anne. "This trigger—what sort of thing could it be?"

"Practically anything." Anne had slumped a bit in her chair; clearly, she had counted heavily on getting the information she sought. "Seasonal changes, atmospheric contaminants, trace elements in food or water. Maybe a different gravity or sunlight spectrum."

"Or something even subtler," Kenton put in. "Magnetic field line distributions, say, or levels of overcrowding among the Thrulmodi."

"I get the point," Kertesz said heavily. "Are you recommending immediate transport of the aliens back to Krüger 60?"

"Only if you're willing to kidnap them." Anne smiled wanly at their startled looks. "I talked briefly to the ambassador this morning, and he flatly refuses to leave until his task has been completed."

Kertesz stroked his lower lip. "That's the sort of thing I would expect from him. Maybe I can change his mind. Blair, I want you to send for your piggyback ships, in case I succeed. Dr. Rolland—" He hesitated. "Just do the best you can, I guess. I'm sorry."

The ambassador remained adamant in his refusal to leave Cygni. However, he consented to being moved to a special treatment room that was hurriedly set up in the medical wing, where Anne's staff concentrated on duplicating as much of the alien home world as possible. Conversations with the Thrulmodi yielded rough ideas as to their world's gravity, length of day, and the current seasonal conditions in the ambassador's hemisphere. The light in the room matched Krüger 60-B sunlight in spectrum and intensity; the other parameters were similarly adjusted.

None of it did any good, and the ambassador steadily grew weaker. To complicate matters, one of the cranial tumors began to put pressure on the brain, causing severe headaches, dizziness, and blurred vision. The human doctors knew enough Thrulmod biochemistry by now to treat such symptoms, but a cure for the cancer itself seemed as remote as the bottom of a black hole.

Kenton was standing on a third-floor balcony of the medical wing, looking at the stars and listening to the silence. In the past some of his best ideas had come to him under the night sky, but this time the trick wasn't working. Maybe it only worked on Earth.

The latest attempt at curing the ambassador's cancer had just failed. All the standard techniques—plus the exotic, unorthodox, and experimental ones—had now been tried, and the medical staff was running out of ideas. But that didn't matter much any more. Commodore Southern's four Nova-class ships would arrive tomorrow, but they would be too late to help. The ambassador's cranial tumor had grown to a critical

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size, and Anne estimated that permanent brain damage would occur within twelve days. Death would soon follow.

Out there, somewhere, was Krüger 60. Kenton located the spot, but the twin stars were a couple of magnitudes too dim to see.

Surgery was out of the question, of course. No surgeon would even consider anything like that with only EM scanner-probe data to guide him; such data left far too many practical questions unanswered. Major brain surgery was even farther out of the question.

To his left, across the dark sand, he could see the Thrulmod ship, dimly lit by the warning lights that circled it. Red warning lights, the same color as Krüger 60.

What would they say if that ship returned home without its ambassador? Or, for that matter, without any of its passengers—after all, everyone had the disease.

Everyone except the aide. Who had undergone a Rebirth.

Why could the aide have a Rebirth and the ambassador couldn't?

Warning lights, keeping people away from the ship. Was Krüger 60 a giant double warning light in space, telling humans to stay clear? We should have listened, he thought. Look at the mess we're in now.

Warning lights. . . .

And the ghost of an idea brushed lightly at Kenton's mind. It wasn't a pleasant idea, and the more he stared at it the less he liked it. But the ambassador was dying anyway.

He found Anne hunched over the reports of their most recent failure. "Do we still have the tight-beam neutron howitzer we used for those radiation treatments?" he asked without preamble.

She frowned up at him. "Yes. Why?"

He told her.

There was the sound of a footstep behind him, and Kenton opened his eyes as Anne stepped out onto the starlit balcony and collapsed into the lounge chair beside him.

"How's the ambassador?" Kenton asked her.

"Almost strong enough to start on solid food again," she answered with weary contentment. "We'll keep him on intravenous for another hour, though. I still don't know how he lived through that—did you know he lost nearly twelve percent of his weight in that Rebirth?"

"Stubborn old coot," Kenton opined. "He *did* refuse to leave until his mission was finished, you'll recall." He looked up as Kertesz appeared.

"I trust I'm not intruding?" Kertesz asked.

"Not at all, sir." Kenton wondered if etiquette required him to stand up. He hoped not; five days of stims instead of sleep had finally caught up with him.

Kertesz solved the problem by snaring himself a chair and sitting down. "I want to congratulate you both on your fine work in curing the ambassador. Dr. Rolland, I'm including a commendation of your entire staff in my official report. I know you'll be writing up a formal statement, but I wonder if you could give me a quick idea now as to what this Rebirth is all about?"

"It's the ultimate in cancer and viral

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disease cures," Anne explained. "There are three glands we call Alpha, Beta, and Gamma high up in the chest cavity and protected by an extra wall of armor-plate material. At the proper time Alpha secretes its fluid into the bloodstream. This fluid is composed of complex molecules that attach themselves to healthy ThNA throughout the entire body. By 'healthy' I mean undamaged; if the ThNA ring has any break in it or if it's been attacked by a virus, then the Alpha molecule won't adhere.

"When this is done, Beta releases its fluid. This chemical, in turn, won't bother any of the ThNA-plus-Alpha-molecule combinations, but literally tears apart all unprotected ThNA rings. When a cell's ThNA goes, a chemical chain reaction fragments the cell and dumps it into the bloodstream as waste matter to be excreted.

"Finally, after all the damaged cells are gone, the fluid from Gamma goes through and splits the Alpha molecule from the ThNA, leaving the ThNA to function as normal. The Alpha and Gamma fluids are then excreted."

"And the patient goes on an eating spree to make up the lost mass," Kertesz nodded. "But I need to know what triggers it."

Anne hesitated. "Dr. Langly can explain it best, sir. It was his insight that gave us the answer."

Kertesz cocked an eyebrow. "Dr. Langly?"

"It was staring us in the face all along," Kenton said, a twinge of self-reproach momentarily tightening his mouth. "But for some reason it never occurred to us. The Thrulmodi implied they were largely immune to radiation effects and, furthermore, used a poorly shielded fission reactor on their ship; yet we *know* that radiation can cause cancer, a disease they claimed was unknown to them. Either they were lying or else had a pretty effective cancer cure they didn't know about. Their Rebirth was the obvious candidate.

"When the ambassador became ill we correctly suspected a Rebirth was overdue, but we couldn't trigger it. Then, four days ago, I happened to remember their doctor's comment that fission was the major source of power on their world. We used fission ourselves back in the 1900's, but it was never our *major* energy source, largely because the fuel, safety features, and waste disposal proved too expensive. There was only one way I could see to make it economical enough for widespread, long-term use."

"And that was if the planet surface were riddled with radioactive material," Kertesz said quietly. It wasn't a question.

Kenton frowned. "You knew?"

"I guessed," he corrected. "I hoped I was wrong. So the trigger is a high backgrown radiation level?"

Kenton nodded. "The gland Alpha is sealed off from the bloodstream by a radiosensitive membrane. When it's been sufficiently damaged by radiation, it disintegrates and starts the Rebirth. The aide must have been right on the verge when they got here, and the accumulated low-level radiation in his blood finished the job. But the others hadn't collected enough direct radiation at home to keep Rebirth on schedule, even though there was enough damage to generate several tumors. Directing a

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stream of neutrons onto the blocking membrane got the process started." He grimaced. "Unfortunately, we had to use a high-density beam to get any results, and back-scattering from it seems to have permanently harmed the reproductive organs. It's a high price to pay for life."

"Yes." Kertesz gazed at the stars in silence for a moment. "We'll have to give them Krüger Base now. I pity them."

"What?" Anne asked, caught off-balance by the abrupt change of subject. "Why?"

"Sorry. I was thinking out loud."

"Why do we have to give them Krüger Base?"

"Oh, not for any legal reasons. Only for—well, for moral ones." Kertesz sighed. "Look. The Thrulmodi are a young, aggressive race, very much like us in some ways. They have spacecraft and are exploring their own system, and almost undoubtedly they dream of star travel and colonization. Only it's all finished now, before it even started. They may never truly escape their system."

Kenton suddenly understood. "The radiation. They can't have Rebirth without it. And without Rebirth they're vulnerable to all forms of cancer and viral disease. They wouldn't last six months in a non-sterile environment."

Anne's face was carved from stone. "Oh, no," she breathed. "But couldn't they carry some radioactives with them?"

Kenton shrugged. "Maybe, although that might concentrate the radiation too much. But it doesn't matter. You can't really colonize a world wearing spacesuits and life-support gear. It's just not the same; you're always aware you don't belong. And what about food? Their plants and animals probably need radiation to live, too."

"But there must be other worlds out there with surface radioactives," Anne argued. She was almost pleading for a straw to grasp at, Kenton realized with a start. Then he understood: a child of colonists herself, she could feel the aliens' loss in a way he himself never would.

"I'm sure there are," he said gently. "But where? It's not like the whole galaxy is open to us. Hyperspace drag puts severe limits on both speed and range, and most of the systems just outside the Alliance claims are controlled by other races. It could be centuries before one of our farspace probes stumbles across such a rare planetary type again."

"That's why I think they should have Krüger Base," Kertesz said quietly. "The planet's loaded with pockets of radioactives. They should be able to live there without too much trouble. And it *is* their own home system, after all, so they should have prior claim."

"Will the Centrum agree?" Kenton asked.

"I'm not sure. But I think public opinion will eventually force them to, especially if I can convince the Thrulmodi to let their hostages go first. Magnanimity is good politics." He stood up. "If you'll excuse me, I have to finish my preliminary report by morning." At the doorway he paused, as if remembering something. "By the way, Dr. Rolland, I'm going to include a recommendation that Cygni be granted Autonomous World status without all the

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usual requirements. I thought you'd be interested."

"Thank you, sir," Anne said, without enthusiasm.

"No thanks needed. You all worked hard for it. Good night." Kertesz disappeared into the building.

For a few minutes there was silence on the balcony. Then Anne said, "It doesn't seem fair, somehow. They have as much right to space as any of us."

"At least they'll get Krüger Base. I'm glad Kertesz is giving up our claim."

"It's small consolation for the loss of a dream."

"Yeah." Kenton yawned widely.

Sighing, Anne got to her feet. "There's no reason for you to hang around, you know," she told him, stifling a yawn of her own. "The crisis is over; my staff can handle things from here on. You ought to get to bed."

"I'm heading there as soon as my last stim wears off. How about you?"

"I'm going to check on the ambassador one last time." She hesitated. Then, almost timidly, she touched Kenton's arm. "Thank you for your help. We couldn't have done it without you."

He looked up in surprise, then smiled. "You're quite welcome, Anne. Good night."

"Good night, Kenton."

Alone again on the balcony, Kenton found himself staring into the night sky in the direction of Krüger 60, the Thrulmod sun. He was thinking of that sun, and the planet whose people could never really leave it, when he fell asleep.

He slept fitfully, and dreamed of cages. ■

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XENOBIOLOGY

Dr. Robert A. Freitas, Jr.

Xenology is the study of all aspects of life, intelligence, and civilization indigenous to environments other than Earth. Over the last three decades xenology has advanced rapidly on many fronts. Biochemists have studied the origin of life on this planet, knowing that if they can duplicate the major early steps of "abiogenesis" in the laboratory then the evolution of alien life is a very likely—maybe inevitable—event. NASA biologists have spent much time developing sophisticated life detection instruments such as the miniature biochemical automated test laboratories carried to Mars by Viking in 1976. There is growing interest in SETI, the Search for Extraterrestrial Intelligence, in which radio scientists look for powerful transmissions or leakage radiation from advanced extraterrestrial supercivilizations. (Most recently the search has been broadened, by myself and a few others, to include the possible observation of alien interstellar probes and artifacts here in the Solar System.) Astronomers are also looking for direct evidence of planets circling nearby stars, a task which will be much easier once the Space Telescope is launched into Earth-orbit as early as 1983.

Xenobiology—the study of alien lifeforms—is a major subdiscipline within the xenological sciences. Its subject matter is the set of all possible life systems in the universe, rather than just the biology of a single world. The common assertion that xenobiology is "a science in search of a subject" because no extraterrestrials have yet been found ignores the long evolutionary history of our planet. From the cosmic point of view, Earth is an alien world as exotic as any in the Galaxy.

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Biological Chauvinisms

The term "chauvinism" derives from the name of Nicolas Chauvin, a highly jingoistic soldier born at Rochefort in the late 18th century. In 1815 Chauvin achieved notoriety by his stubborn, bellicose attachment to the lost cause of Napoleon's crumbling empire. Since that time the word has come to be associated with any absurd, unreasoning, single-minded devotion to one's own race, nationality, sex, religious persuasion, or, more generally, to one's own peculiar point of view. Chauvinisms usually are associated with ignorance—in view of our lack of hard knowledge about lifeforms elsewhere in the universe, chauvinisms are predictably common in xenobiology.

For instance, there used to be the notion that oxygen (O_2) is absolutely required for higher life. Many xenobiologists today categorically reject this proposition. Oxygen was largely absent during the first few billion years of evolution on Earth, and many organisms today still do not need this element to survive. Experiments have shown that plants grow better in air containing only about half the normal amount of oxygen, and the presence of O_2 in the nuclear regions of contemporary living cells is usually fatal. Human scuba divers are poisoned by the gas at more than a few atmospheres pressure. Large creatures on any world may need some strong oxidant to power their bodies, but it may not have to be oxygen.

Another early biological chauvinism was the insistence that life is an especially fragile phenomenon limited to a very narrow range of environments. During the 1960s scientists examined the extremes of terrestrial life and found that the flora and fauna of Earth (especially microorganisms and other simple lifeforms) resist death even when subjected to conditions that would quickly kill a human being.

For example, *Thiobacillus* microbes flourish in some of the strongest acids known to man whereas the blue-green algae *Plectonema nostocorum* thrives in the strongest bases. The rugged tardigrade can survive periods of total dehydration and may be frozen to near absolute zero or heated to more than 120° C without dying. Biological growth and reproduction have been demonstrated in the laboratory from -24° C up to 104° C, and deep sea bacteria and other animal lifeforms survive exposure to pressures in excess of 8000 atm (Earth-normal at sea level is 1 atm). *Micrococcus radiodurans* and several algal species are found happily growing in the core water of nuclear power plants, enduring radiation that would kill a person almost instantly. When a TV camera was retrieved from the American lunar probe Surveyor 3 by Apollo astronauts, a colony of *Streptococcus mitis* bacteria was found growing inside the lens. These hardy microbes evidently survived three years of hard vacuum, no food or water, exposure to cosmic rays, and temperatures ranging from well above the boiling point of water in the daytime to -160 °C during the night.

Spacecraft sent to other planets in the last decade have returned a fascinating wealth of information about our nearest

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neighbors in space. Jupiter, long considered too cold for life, is now believed to have an atmosphere rich in organic compounds and cloud temperatures warm enough to permit liquid water to exist. The Jovian moon Europa may have an ocean of water as deep as Earth's seas trapped beneath its frozen surface (which could harbor life), and Io, another Jovian satellite, is thought to possess great underground pools of molten sulfur and tenuous sulfur dioxide air outgassed from the interior by active volcanoes. Titan, the largest moon of Saturn, has a thick atmosphere possibly containing hydrocarbons and other organic substances, and the presence of ammonia may produce a warming "greenhouse effect" which could raise surface temperatures up into the range of Earthly biology. The Viking mission to Mars found no unequivocal evidence for life, though some may have survived from an earlier, wetter epoch, yet escaped detection by hibernating in the Martian polar regions or deep underground. Finally, the Pioneer Venus spacecraft discovered water vapor in the Venusian atmosphere just under the main cloud deck in concentrations up to 0.5%. This is somewhat dry by terrestrial standards but still plenty wet for biology to retain a precarious foothold if it exists. The search for life in our Solar System is only beginning.

Carbon/Water Lifeforms

All living creatures we know about are made up of complex carbon compounds immersed in liquid water. It may be that all life in the universe must take this form. Earthly biology has two main components: *DNA* (chains of nucleic acids), the carrier of genetic information and the blueprints for inheritance, and *protein* (chains of amino acids), the raw materials and tools with which to build living beings. If we limit ourselves to lifeforms using DNA and protein in a carbon/water biochemistry, are there any workable alternatives within the basic terrestrial format?

For years it has been assumed that the genetic code is universal to all Earth life. This code, used to write the instructions (called "codons") on chromosomal DNA for protein production by cells, was believed to be shared by plants, people and bacteria alike. In late 1979, scientists of the Medical Research Council in Cambridge, England and researchers at Columbia University in New York made a truly amazing discovery: The code is not universal! Apparently several of the codons used in mitochondria (the main sources of metabolic energy in cells) have a different meaning than the same codons would have in the surrounding, more "normal," cellular cytoplasm.

This research raises a number of intriguing questions. How much variation is permissible in genetic coding schemes? Might primitive lifeforms from earlier stages of terrestrial evolution have had some different system altogether? Are alternative inheritance codes possible, with genes written in a self-consistent language untranslatable by human cells? Could nucleic acids other than the five in our biochemistry appear in some alien genetic system?

Dr. Alexander Rich, a prominent

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MIT biochemist, believes that the functions of Earthly nucleic acids are not unique. He has suggested that other molecules could be used in organic chains called polymers which might be used as information carriers in extraterrestrial living systems. At the Conference on the Origin of Life held at Princeton in May, 1967, Dr. Rich commented that "it would be amusing to make a chemical system of complementary polymers based on monomers that are not nucleic acid derivatives, simply to demonstrate that it can be done. In about ten years' time I think we will have a well-developed field of synthetic polymeric information carriers that will give us a great deal of insight into our own terrestrial system. That another system is possible might have relevance, if not to biology on *this* planet then perhaps to another."

In December 1979 Dr. Rich and his colleagues at MIT announced the discovery of a new form of sythetic DNA polymer. Normal genetic material, called B-DNA, has the familiar double-helix structure with a right-handed direction of twist. The new DNA, synthesized for the MIT group by scientists in the Netherlands, has both a left-handed twist and a markedly different molecular surface structure than the B form. Rich calls it Z-DNA, after the zig-zag pattern of the phosphate groups which serve as the molecular backbone for DNA.

Since the Z-DNA was synthesized from scratch, nobody knows yet if this unusual form of genetic material occurs naturally in living cells. Dr. Rich's team has begun a series of experiments to find out. If researchers can identify proteins that bind to the synthetic structure, then it is likely that Z-DNA may be found somewhere in nature. This raises an even more interesting question for xenobiologists. Terrestrial chromosomes are constructed (so far as we know) entirely of B-DNA, but could extraterrestrial biochemistries exist which transmit genetic information mainly using Z-DNA? Dr. Rich thinks that there may be proteins which preferentially bind to left-handed rather than right-handed DNA. These proteins might even consist of amino acids that normally play no role in terrestrial life systems. Alien creatures based on a Z-DNA code doubtless would find our foods, drinks, drugs, cells and bodily fluids wholly incompatible. There is little danger that such visitors to our planet could transmit a lethal pathogen during first contact and start a plague on Earth.

How about alternative proteins in a carbon/water biochemistry? Chemists long have been aware of literally hundreds of amino acids in addition to the normal 20 which make up all protein molecules coded by DNA in human biology. No one knows exactly why these particular 20 were selected by evolution for the job. There seems nothing to prevent each extraterrestrial carbon/water DNA/protein life chemistry from having its own unique set of amino acid building blocks. A simple combinatorial calculation reveals the extent of this uniqueness: There are more than 10^{27} ways randomly to choose a set of 20 amino acids for use in alien protein from a total of, say, 200 possible amino

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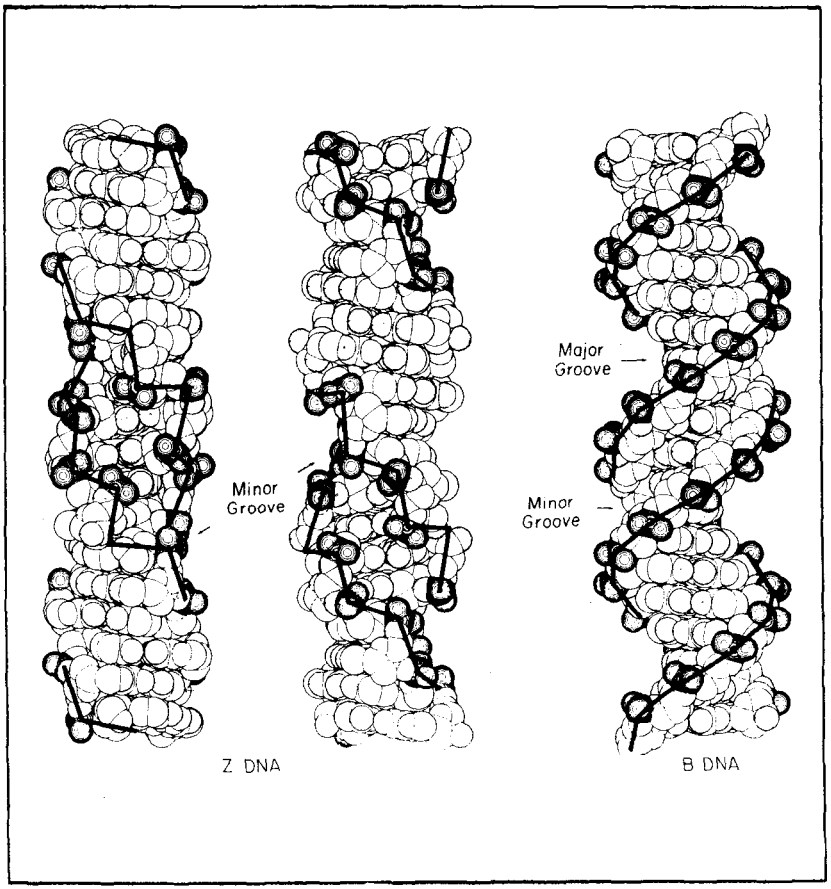

acids, or about one million completely different protein systems theoretically available for every planet of every star in the universe.

Like Z-DNA, alternative protein structures may readily be imagined. To see how, we must go back to the prebiotic synthesis experiments conducted by Dr. Stanley Miller and others in the 1950's. Dr. Miller (now at the University of California at San Diego), in order to reproduce the composition of Earth's atmosphere before life began, mixed together methane, hydrogen, ammonia and water in a closed vessel from which all oxygen had been removed. The gases were circulated past an electric spark discharge to simulate the effects

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of lightning. After a week Miller removed the contents for analysis and found a startling variety of organic compounds important to terrestrial life—including amino acids.

The basic shape of an amino acid is a short chain of carbon atoms with a small amino group ($-NH_2$) stuck on somewhere. There are two common forms of amino acids, called alpha and beta. Most all terrestrial proteins are of the alpha variety, in which the amino group appears near the tail end of the amino acid molecules. The beta forms, with the amino group displaced more to the front of the chain, are virtually absent.

The explanation for this selection may lie solely in the order in which water is introduced during the early stages of prebiotic evolution, according to Dr. Peter M. Molton, formerly of the Laboratory for Chemical Evolution at the University of Maryland. Miller-type experiments demonstrate that if water is present initially in the primordial "soup," only alpha amino acids are produced and life evolves with alpha proteins. But if the early products of chemical evolution don't encounter water until much later, then the beta amino acids predominate. If this happens on another world, the resulting extraterrestrial lifeforms could have beta rather than alpha proteins and would probably not be edible by humans. They might even be poisonous, a fact of considerable importance to future interstellar colonists, tourists and soldiers.

Biology without Water

The reactions of terrestrial biochemistry take place in water, an amazing substance with a whole set of properties ideal for our kind of life. Over the years one of the most persistent and seemingly most reasonable biological chauvinisms has been the contention that water is the only good biochemical solvent. But this view is slowly changing.

Today, xenobiologists regard ammonia (NH_3) as the leading alternative to water for hypothetical alien life chemistries. Ammonia is known to exist in the atmospheres of all gas giants in the Solar System and is thought to have been plentiful on Earth during the first billion years of our planet's existence. The only solvent more abundant in the universe is water, and at pressures below about 10 atm water freezes out as solid ice over the entire temperature range for which ammonia is a liquid. We can easily imagine ammonia lakes or seas on other worlds, though these may not be necessary for the origin of ammono life. A thick mist concentrated in some stable layer in a quiescent Jovian atmosphere like that of Saturn might suffice.

To be useful in biology a solvent must remain in the liquid state. Some scientists have claimed that the liquidity range of ammonia is too small for it to replace water in any alternative biochemical system. The liquidity range of water at normal pressure is exactly 100° C (0° C to 100° C) as compared to only 44.3° C (-77.7° C to -33.4° C) for ammonia. But is this difference really relevant? Virtually all lifeforms on Earth occupy environments between 0–44° C, and prebiotic chemical evolution as presently understood does not require

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a medium much beyond this temperature span. Further, the liquidity range of ammonia may be broadened by increasing the pressure. At just 60 atm, far less than the pressures encountered near the surface of Venus or in the dense clouds of Jupiter and Saturn, ammonia boils at 98° C rather than -33.4° C. (Ammono life is not necessarily low-temperature life.) Ammonia thus compares favorably to water at elevated pressures.

Much is often made of water's virtually unique property of expanding when it freezes. Ice is less dense than the liquid, so it floats on top and protects creatures swimming beneath the surface. Ammonia seas would freeze from the bottom up because the solid is more dense and sinks, causing the entire environment to solidify during periods of extreme cold and smothering to death any organisms living there. Ergo, ammonia is an inferior solvent.

But this neglects the fact that water freezing within the cells of living tissue opens the door to a new hazard also unique to water—mechanical damage by expansion! Ammonia *shrinks* when it freezes, so cellular damage is far less likely. The very property which might create massive oceanic freeze-ups should also allow ammonia-based lifeforms to be much more successful hibernators in a frozen milieu.

The acid-base chemistry of liquid ammonia has been studied extensively throughout this century and has proven as rich in detail and complexity as the water system. Ammonia dissolves most organic compounds as well as or better than water and has the unprecedented ability to take many metals directly into solution, including sodium, magnesium, aluminum and several others. Iodine, sulfur, phosphorus and selenium also are somewhat soluble with minimum reaction, each important in terrestrial life chemistry or prebiotic synthesis. As a chemical solvent for life, ammonia cannot be considered inferior to water.

Several series of ammonia-based analogues to the macromolecules of Earthly life have been designed by enterprising xenobiologists, including substitutes for alcohols, amino acids, fatty acids, proteins and carbohydrates. But we don't know if ammono life will have the same chemical forms found in terrestrial biochemistry. Undoubtedly there are as many different possibilities in carbon/ammonia as in carbon/water biologies. One suggestion by Peter Molton is that ammono life may use cesium and rubidium chlorides to regulate the electrical potential of cell membranes. These salts are more soluble in liquid ammonia than the potassium and sodium salts required by watery life on Earth.

Numerous other biological solvent systems have been proposed from time to time, as for instance sulfur dioxide, hydrogen fluoride, methane, hydrazine, chlorine and sulfur. Though its solution chemistry is virtually unknown, liquefied carbon dioxide (CO_2) is yet another plausible alternative. Under normal pressure CO_2 exists only in the gaseous or solid ("dry ice") states, but above 5.2 atm pressure the liquid state can also be reached. If the planet Venus (with 96% pure CO_2 air at 90 atm pressure)

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suddenly were moved to an orbit somewhere near the Asteroid Belt, most of the atmosphere could precipitate out and fall as rain, creating planetary oceans of liquid carbon dioxide about a kilometer deep.

Biology without Carbon

Most biochemists find it difficult to imagine a biology based on any element other than carbon. Carbon atoms easily bond together to make long polymeric chains and can combine with a large number of other elements to form a bewildering variety of different molecules with many useful biochemical properties. But is it unique in this respect? Since at least the beginning of this century a few researchers have speculated on the possibility of replacing carbon with silicon in living systems. This suggestion arises mainly because silicon lies directly below carbon in the Periodic Table of the Elements (a systematic grouping of elements according to their properties) and as such is carbon's nearest neighbor chemically.

Traditionally the idea of silicon life has received a chilly reception from the scientific community at large. One common complaint is that carbon atoms are about ten times more plentiful in the universe than silicon atoms: All else equal, carbon should be favored every time. But most biochemical evolution probably takes place on planetary surfaces. We know that silicon comprises roughly 25-30% of the total surface composition of all terrestrial worlds whose soil has actually been tested. In Earth's crust silicon atoms are a hundred times more numerous than carbon atoms. Carbon is even rarer on the Moon, and in the Martian crust there is no trace of it down to the parts-per-billion level.

One often hears that carbon chemistry is far more diverse than silicon chemistry, hence more suitable for the intricacies of living systems. More than two million carbon compounds are known today as compared to a paltry 20,000 silicon-based substances. But vastly more research effort has been expended on behalf of carbon due to its obvious biological and medical importance. Serious interest in silicon chemistry awakened only a few decades ago and has since moved at a relatively slow pace. The apparent poverty of silicon compounds may in large part be due to a lack of commitment among chemists.

The customary *coup-de-grâce* of the carbon chauvinists is to assert the inability of silicon atoms readily to hook together into long polymeric chains. No chains, it is alleged, means no biochemical complexity, therefore no life. Is this a valid conclusion?

Many think not. It is quite true that silicon atoms have trouble linking up to form stable noncrystalline structures, but this really says little about the possibility of Si-life. Earthly proteins, carbohydrates and nucleic acids—the three most important polymeric substances in terrestrial biochemistry—rarely include more than a few consecutive carbon atoms. Organic side chains may contain up to eight carbons, and certain fats and vitamins many more, but the basic molecular backbone of life makes do with only a few. For example, most proteins consist of a repeating sequence of just two carbon atoms and a nitrogen of the

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form -C-C-N-C-C-N-. Life needs stable macromolecules, not merely long chains of identical backbone atoms.

Silicon life may actually be possible! In combination with oxygen, nitrogen, and several other elements Si makes a variety of ring-shaped and straight-chain polymers stable in high ultraviolet fluxes and at very low temperatures. Silane (SiH_4), the silicon analogue of methane (CH_4), might serve as solvent for a cold silicon biochemistry under anhydrous reducing conditions. Si-Si bonds tend to break up in the presence of water or ammonia. Fortunately the liquidity range of silane (-185° C to -112° C) lies well below the melting point for either of these more abundant solvents, so both water and ammonia should be frozen out in "mineral" form. Pools of liquid silane may seem incredible, even preposterous, to many. But we should remember that natural lakes of molten sulfur were regarded as utterly ridiculous too—until scientists discovered them on Earth beneath the volcanic crater of Volcan Poas in Costa Rica in 1977 and on the Jovian moon Io during the Voyager flybys in 1979.

In recent years chemists have discovered a wealth of inorganic polymer classes based on various unusual elements. Silicones, for instance, are polymers with alternating silicon and oxygen atoms stable to very high temperatures. Long carbon chains easily link to the silicone backbone, offering the interesting possibility of a carbon/silicon hybrid biochemistry. The element boron also is now known to form large stable molecular structures in some cases superior even to carbon. Boron is an amazingly versatile element—literally thousands of compounds have recently been synthesized (many with extreme high temperature tolerance) and more than 40 elements, nearly half the Periodic Table, have been successfully incorporated into boron's unique molecular "cage" architecture. Boron-nitrogen compounds, often referred to as "pseudocarbons" by specialists in the field, represent a whole series of remarkable direct analogues to carbon-based organic substances.

General Xenobiology

It is useful at this point to ask exactly how biochemical biology is relevant to our study of alien beings. A xenologist who speaks of "lifeforms" most generally refers to an entity or material system that metabolizes both matter-energy and information. (Metabolism is any mechanism which accepts a set of inputs and then processes them to produce a specific set of outputs.) A few might also demand that each metabolism be survival-oriented or geared for reproduction, but it is clear that the lifeform concept is vastly broader than traditional notions based on Earthly life. Xenobiologists would argue that while all biochemical biological entities must be lifeforms, not all lifeforms need be biochemical in constitution.

Life requires metabolism, a systematic manipulation of matter-energy and information. But manipulation can only be accomplished by the application of force. Physicists tell us there are just four fundamental forces in nature. Most powerful is the *nuclear* or *strong* "chro-

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modynamic'' force, responsible both for binding protons and neutrons together in atomic nuclei and for holding subnuclear ''quarks'' together within individual protons, neutrons and other particles. Less strong is the *electromagnetic* force, which provides the attraction or repulsion between charged objects and predominates in the chemical reactions of terrestrial biochemistry. The *weak* force mediates many processes of radioactive decay. Finally there is *gravity*, by far the weakest force, which manifests itself in the universal attraction of all matter-energy. We can imagine four broad classes of metabolic entities—chromodynamic or nuclear lifeforms, electromagnetic lifeforms (e.g., all Earth life, including humans), weak lifeforms, and gravitational lifeforms. Each is most likely to evolve in those environments where the forces upon which they most depend predominate over all others.

For example, gravitational lifeforms, should they exist, survive by making use of the most abundant form of energy in the universe. Gravity is also the most efficient—this is why a hydroelectric power station which converts the energy of falling water into electricity (essentially a controlled gravitational contraction of the Earth) can have an efficiency close to 100%. In theory gravity beings could be the most efficient creatures in the universe. Their energy might be derived by arranging encounters of collisions between black holes, galaxies or other celestial objects, or by carefully regulating the contraction of various objects such as stars or planets. These beings need not be astronomical in size. Rotational and orbital motions of planetary bodies could serve as sources of gravitational power. Comparatively small lifeforms might survive by harnessing the energy of waterfalls, wind patterns, tides and ocean currents, or even seismic disturbances.

Chromodynamic creatures may evolve in an environment where nuclear forces are predominant. While the chromodynamic force is the strongest in nature, it is effective only over ranges of about 10^{-15} meter, so very special conditions might be required for such life to exist. These conditions possibly could be found inside a neutron star.

Neutron stars are heavy, rapidly spinning objects 10-20 kilometers in diameter with approximately the mass of a star. They have densities like nuclear matter, tremendous magnetic fields, surface gravities in excess of 100 billion Earth-gees, and are thought to be the energy source for pulsars. Neutron stars have atmospheres half a centimeter deep and mountains at most one centimeter high. Under the three-kilometer crust of crystalline iron nuclei a sea of neutrons circulates at a temperature of hundreds of millions of degrees. In this sea float a variety of nuclear particles including protons and atomic nuclei. Scientists believe that there may be neutron-rich ''supernuclei'' or ''macronuclei'' dissolved in the neutron sea. These macronuclei might contain thousands of nucleons (as compared to only a couple of hundred in normal matter) which could combine to form still larger supernuclei analogous to the macro-

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molecules which make up earthly life. The neutron sea may be the equivalent of water in the primordial oceans of Earth, with macronuclei serving as the equivalents of amino acids, carbohydrates, and nucleotides in the prebiotic origin of life. It is possible to conceive of life evolving in neutron stars much as it did on our own planet nearly five billion years ago, but substituting atomic nuclei, supernuclei and neutrons for atoms, molecules and water.

Weak force lifeforms would be creatures unlike anything we can readily imagine. Weak forces are believed to operate only at subnuclear ranges, less than 10^{-17} meter. They are so weak that, unlike other forces, they don't seem to play a role in actually holding anything together. They appear in certain kinds of nuclear collisions or decay processes which, for whatever reason, cannot be mediated by the strong, electromagnetic or gravitational interactions. These processes, such as radioactive beta decay and the decay of the free neutron, all involve neutrinos.

A weak lifeform might be a living alchemist. By carefully controlling weak interactions within its environment, such a creature could cause its surroundings to change from a state of relatively high "weak potential" to a condition of low "weak potential" and absorb the difference into itself. A state of high "weak potential" might be characterized by extreme instability against beta decay—perhaps these beings are comprised of atoms laden with an excess of neutrons and become radioactive only when they die.

Such lifeforms seem impossible in our present universe, but all may not be lost! Modern cosmologists believe that at the beginning of time the weak and electromagnetic forces were fundamentally the same—both obeyed the same sort of inverse square law and both were about the same strength. During the Big Bang as the universe cooled to below $3 \times 10^{15^{\circ}}$ K, a kind of "phase transition" is theorized to have occurred. Much like the sudden freezing of water, the weak interaction abruptly parted company with electromagnetism and became what it is today—weak and extremely short-range. Recently the Nobel laureate physicist Steven Weinberg suggested that there may exist regions in the universe where the weak force is still comparatively strong. Says Weinberg in *The First Three Minutes*: "When water freezes it does not usually form a perfect crystal of ice, but something much more complicated; a great mess of crystal domains, separated by various types of crystal irregularities. Did the universe also freeze into domains? Do we live in one such domain, in which the symmetry between the weak and electromagnetic interactions has been broken in a particular way, and will we eventually discover other domains?"

Electromagnetic lifeforms also may assume many different shapes. Any creature that makes use of electromagnetic atomic bonding, electron flows, or electric and magnetic fields is a member of this class. All biochemical life on Earth or any other planet meets this test, but there may be many other kinds of alien living systems which also qualify. For instance, the advancing intel-

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ligence and versatility of electronic computers suggests that some sort of solid state "machine life" may be plausible. Such entities would survive by manipulating electron flows and fields in order to process matter-energy and patterns of information.

Another outré possibility is the proposal by Jean Schneider of the Groupe d'Astrophysique at the Meudon Observatory in France that a crystalline nonchemical form of life is theoretically feasible using arrangements of crystal dislocations. Schneider describes a primitive memory process that provides a rich, stable information storage system, using what he calls "dislocation loops" which can react and interlock and are capable of being diffused into the surrounding medium in coherent form. Such crystalline physiologies might be found in any of four different places: (1) the rocks on Earth and other planets; (2) interplanetary or interstellar dust grains; (3) in the dense matter of white dwarf stars; and (4) in the crust or core of neutron stars.

Venturing still further afield, someday we may meet electromagnetic creatures such as those described in astronomer Fred Hoyle's *Black Cloud*. In this science fiction classic, a great cloud of ionized gas approaches our Solar System and engulfs the Sun, shutting out its light and warmth. Scientists eventually discover that the Cloud is a giant living creature operating on the principles of plasma physics rather than the usual molecular biochemistry. Memory and intelligence are stored on an electrically conductive substrate of various solid materials. Streams of ionized gases carry "nutrients" to wherever they are needed within the Cloud, controlled purely by means of electromagnetic forces.

It is very likely that ours is just one possible life chemistry of many, and that all biochemical life is only one of many modes of xenobiological existence. But regardless of what shape they take, all lifeforms are worthy of our curiosity and respect as manifestations of the same fundamental unity and cosmic order that gave rise to life on Earth eons ago. ■

For Further Reading

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Space flights are merely an escape, a fleeing away from oneself, because it is easier to go to Mars or to the Moon than it is to penetrate one's own being.

CARL GUSTAV JUNG

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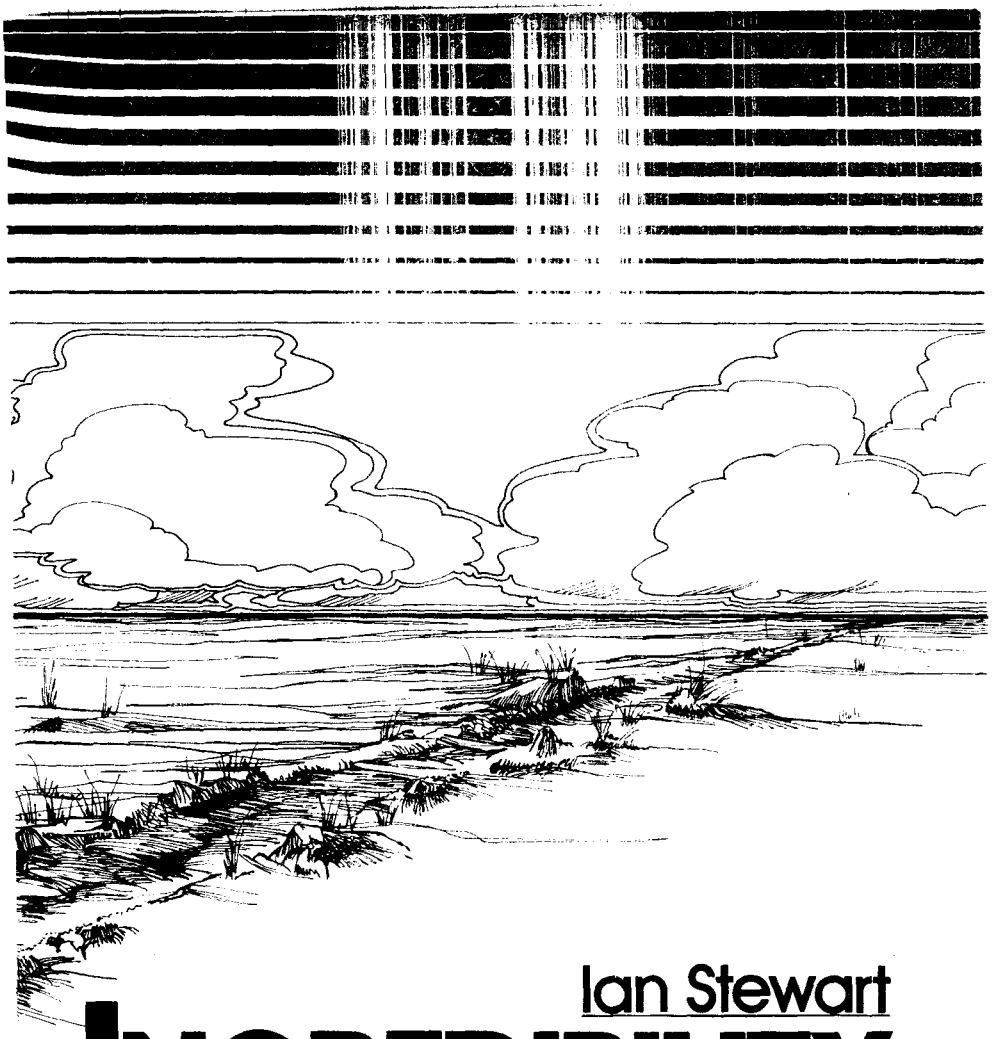

Ian Stewart

INCREDIBILITY GAP

Ingenuity will be recognized, of course—
but it doesn't hurt to make sure!

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An irregular furrow, too straight for natural origins, traversed some half a mile of salt flats to end at the borders of a marsh. It terminated at a crumpled metallic structure recognizable as the remains of a sigmat shuttle, its hull battered but intact, its landing-vanes reduced to mere stubs. Portions of the vanes and certain external equipment were strewn at intervals along the furrow.

A lone figure sat beside the wreckage in a small pool of brine, holding his head between his palms in an attitude of dejection. Then, as though the dampness had penetrated not only his clothing but also his despondency, he rose unsteadily to his feet and clambered back into the vessel.

It took Morgan de Vere the best part of a day to pull all three corpses, the pilot and two crewmen, from the damaged nose-compartment. He dragged them a hundred yards to a place where the salt had weathered into shallow ripples, and hid them behind a clump of splaythorn. When night fell the kshoggi would crawl out from the salt-marshes, and by morning nothing would be left but bones. It would be preferable not to attract the creatures to the vicinity of the shuttle. Nor did Morgan care to contemplate the remains.

He spent the first night behind the dubious protection of the cargo hatch, which though badly twisted could still be fastened shut. He was sufficiently exhausted to ignore the distant rasping of the nightfaring kshoggi, and his sleep was deep and untroubled.

When he awoke the next morning he remembered the cartons of fungicide, sat down on a hummock of silver vetch, and tried to think.

He was stranded about five hundred miles northwest of Crazy Harbour, in the middle of a wilderness of salt. Patches of splaythorn scrub relieved the yellow-grey monotony of the salt flats, while the run-off from seasonal rains collected in hollows to form sour marshes, edged with vetches and haulvers, and matted with colonies of brown aligot. The plants seemed well adapted to their saline environment. Here and there a solitary saltskater would skitter across the ground on its many-jointed limbs, in search of a more succulent cluster of splaythorn tubers. The 'skaters were numerous, and their soft underbellies were vulnerable to attack by the carnivorous kshoggi, as was the unwary traveller.

The salt flats stretched away in all directions as far as the eye could see, broken only by regions of marshland. Overhead an unbroken canopy of swirling cloud rolled endlessly eastward, lagging behind the planet's rotation and thus appearing to move in the opposite direction at a speed of some forty-six miles per hour. Seen from space, Skaun Secundus was a sparkling sphere striped with multicoloured horizontal bands; but seen from its own surface the clouds were grey. Paradoxically, the winds at ground level were erratic and arbitrary, the atmosphere becoming turbulent as its lowest layer rubbed shoulders with the dreary terrain. The cloud layer muted the harsh radiance of the Skaun sun, which would otherwise have rendered the planet inimicable to life.

Morgan reviewed his meagre assets. One wrecked sigmat shuttle. A consignment of two hundred rolls of heavy-

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duty plastic sheeting for the Crazy Harbour polyfarms. One balloon-tired manure-spreader for farmer Massey, an awkward looking hopper affair on four gigantic wheels, designed to be drawn behind a gyrotractor without damaging the crop, and hence unfortunately lacking any motive power of its own. Two-day rations for a four-man crew, which might stretch to last one man two weeks. He could make almost limitless quantities of water, either by burning hydrogen fuel from the shuttle's tanks, or by distilling brine from the marshes.

And, not least, he was in good physical shape.

He sighed. Next, the liabilities. Here the Wheel of Fortune appeared in need of balancing. Saltskaters were inedible to humans, having the wrong amino-acids; so were the local plants. The kshoggi too, although that didn't bear thinking about. The radio was smashed, not that it would have proved useful in any case. The pilot had sent off a distress signal before the crash, but the nearest shuttle was two months' travel away on Skaun Primus. Crazy Harbour was too new a colony to own any ground transport capable of surviving in this wilderness, and it owned no air transport at all. A rescue party was out of the question, since the kshoggi made sure that nothing on foot would last out the night behind anything weaker than armour plate.

Finally—and it was both asset and liability—there were five cartons of fungicide, urgently needed to deal with an outbreak of leafwilt on Fergus Massey's cowcumber crop. Two months' delay was bad enough: a few weeks more and it would ruin the best part of a year's work by Old Man Massey. By itself that would not have caused Morgan any distress, because he hated the Old Man and his caustic jibes; but Morgan was hopelessly enamoured of Massey's daughter Jane.

Morgan Knutsson de Vere was alone in the limitless waste. He should have despaired, but in a curious way it appealed to a romantic streak in his nature.

I'll have to think *my way out.*

Instead, he found himself thinking about Jane.

. . . she nestled in his arms in Old Man Massey's hayloft. Morgan had given her an oddly formed rock, a lump of blue dioptase, brought on the shuttle from Skaun Primus. While she inspected it, he nibbled gently at the coral shell of her left ear. Jane sighed and snuggled up closer. "It's beautiful, Morgan. Just beautiful." She clasped his hand tightly. "Morgan—when are you going to ask Father?"

Morgan always dreaded that question. Not because he had dishonourable intentions, but because her father was a daunting figure of a man, and the owner of Crazy Harbour's best and biggest polyfarm.

As he hesitated, shorn of speech, Jane tugged more urgently at his arm. "I think you should ask him as quickly as you can."

"Why, hunkabee?"

"Because he's just coming up the ladder."

Morgan leaped to his feet and feigned interest in the joinery of the beams. "Good day, Farmer Massey. I was just saying to Jane what a remarkably accurate mortise-and-tenon you

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have. . . .''

Massey ignored him. ''Jane, what are you doing up here with this imbecile?''

''He's not an imbecile, father. He just gives that appearance!''

''What do you mean, not an imbecile? Him? Brainless Morgan? D'you remember when fuzzy plague hit the cabbage crop? It was Morgan de Vere's inspection duty. And why had he not noticed? Because he was mooning over an illicit tub of daffodils!''

''He was growing them as a present for me, Father. Morgan has a very sensitive nature.''

''He'll have a sensitive hide if I get my way,'' said the polyfarmer grumpily. ''And what about that time he reprogrammed the biogene to grow butterflies instead of earthworms?'' The Old Man was slowly working his way from asperity to apoplexy. ''It isn't only me that he's caused trouble for. I haven't forgotten that business with Veterinary Wufnook's image-intensifier, either!''

''I was only trying to see the sunset,'' protested Morgan.

''Sunset! Through *that?*'' Fergus Massey gestured at the rolling grey cloudbanks.

''I hoped the image-intensifier might penetrate the layer. It works pretty well on the abdominal walls of pregnant sows. . . . '' He howled as Jane kicked his shin.

''Father, Morgan has something to ask you.''

''Oh?''

Jane turned to Morgan for confirmation but saw she would get little assistance: he had acquired a sudden resemblance to a goldfish. ''He wants to ask your permission for us to be wed. Don't you, Morgan?''

Morgan managed a strangled gulp. Massey looked thoughtful. Then his shoulders began to shake, his eyes bulged, and his face went redder than Morgan could recollect ever having seen it—and he started to laugh as if nothing could ever stop him. Eventually he gasped air enough to speak. ''Oh dear! Brainless Morgan to wed my Jane!'' And that set him off again.

It was true that Morgan lacked natural sense. The entire population of Crazy Harbour was agreed on that. Even Jane, though she alone thought to discern something deeper behind it. What nobody realised was that it was not Morgan's fault.

It had happened like this.

Colony skipships are fast, but never large enough to carry everything that a colony might need; and there is a dire mass penalty to be paid for superlight speeds. Consequently there is a strong incentive for miniaturization. By a stroke of good fortune, the items most useful to an aspiring colony are also the easiest to miniaturize.

Plants, animals—and people.

Nature worked out that trick long ago.

So, while much of the volume of a skipship is given over to things like balloon-tired tractors and climatological computers and everything-machines, which cannot really be miniaturized at all, but only packed efficiently, most of the people—all save the essential real-time crew—and all of the animals, travel as frozen germ plasm.

In its early days, a colony needs a well-defined and closely circumscribed

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range of talents: builders, farmers, doctors, breeders. Luxury items like lutenists and bureaucrats have to wait their turn, and the rapid-incubation programs are set to give priority to the desired genotypes.

It was some twenty-three years since Morgan de Vere, then known only as embryo KKG-33650-000774-POG, had been decanted into the incubators on Skaun Secundus. But many years before that, on Earth, a technician named Linda Strauss had indulged in an excess of home-brew at a Thanksgiving party. The next morning her eyesight was less reliable than usual, and she misread a genotype selector. In consequence a phial labelled with the codes for a plant biologist acquired the genetic material appropriate to an artist.

The phial was shipped to Skaun Primus—and thence to its branch colony on Secundus—in the skipship *Maundy Thursday*.

That phial was Morgan Knutsson de Vere.

Crazy Harbour, the branch colony beachhead on the shore of the only large lake on Skaun Secundus, never learned that Linda Strauss's hangover was responsible for Morgan de Vere's unorthodox outlook on life, but from an early age it had been apparent that his heart was not in plant biology. His ineptitude at a craft revered by any farming community lent him his nickname, Brainless Morgan.

Finally he was reassigned to a manual post: cargo-handler on the shuttle-runs between Primus and Secundus, bringing in new equipment and taking away the old for repair. While the polyfarmers of Skaun Primus possessed a rustic tendency towards improvisation, most of their equipment was too sophisticated to be successfully mended that way. The qualified engineers of the Skaun system were all on Primus, because that was where the everything-machine was. And while it was possible, though laborious, to load damaged mechanisms into a shuttle, it was quite impossible to do the same with an everything-machine—which, among other tasks, built shuttles. Indeed it built almost anything, except another everything-machine.

Morgan found his new job quite acceptable, as it left him a great deal of leisure time, which he spent sketching on the back of cargo manifests, or painting with materials adapted from other purposes. The inhabitants of Crazy Harbour found his paintings imcomprehensible, executed as they were in panclasmic repressionist style. His not inconsiderable abilities at cargo-handling went equally unrecognised: Brainless Morgan, by definition, was a total incompetent. Morgan vowed that his worth should be impressed upon them, but had so far been unable to devise a foolproof method.

And now here he was, stranded in the saltflats with five cartons of precious fungicide. He knew what the people of Crazy Harbour would be saying.

How very like him.

Morgan sat and thought about Jane . . . and came to with a start. A pleasant enough subject, and no doubt marvellous motivation, it had little practical bearing on the crossing of five hundred miles of saltflats infested by kshoggi. He told himself to concentrate.

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Be systematic.

The key was transport. A maxim tremendous but trite. But what is transport? Something that can move, plus something to make it move. A vehicle, and a power source.

Vehicle first. The ground was smooth, the marshes scattered. No rocks larger than pebbles, no crevasses, no deathless caverns of time-rimed ice. . . . Irritably he dragged his mind back to the problem. Smooth and flat, all the way to the shallow depression of Crazy Harbour, where the salt gave way to the fine silt of an ancient beach. It was this that attracted the farmers, because with irrigation and fertilizer and halophilic plants. . . . Smooth and flat. The manure-spreader's large, soft wheels would cope well enough; they would even float across marshland. There were cable-brakes on each wheel, for steering.

But no motor.

Other power sources? The shuttle had batteries, but only for lighting. Its engine was ruined. Anyway, it weighed six tons. There was the liquid hydrogen fuel, of course . . .

He could make a jet engine!

He could make a jet engine?

Morgan thought again. He had precious few tools, and his knowledge of mechanical principles was negligible. *Keep it simple.* Muscle-power? A treadle, with a chain to transmit rotary motion to the wheels? No, that was silly. The resistance would be too great, the vehicle too massive. And he could hardly keep pedalling throughout the six-hour night, and if he stopped, the kshoggi would get him.

Perhaps he could capture a dozen kshoggi and harness them to the vehicle like a team of huskies. Morgan visualized himself, the reins clasped in his hands and the salt spraying up in a great arc as the manure-spreader howled across the desert, with the hero urging on his team from the prow (or whatever muckwagons had at the front) like Ben-Hur surging to victory in a chariot-race! Oh, the rippling hides of those trusty kshoggi, translucent pink leather, as their coiled muscles propelled them ever onward; and the glittering of their jewelled fangs as they thrust their noble heads before them . . .

Fangs?

Trusty kshoggi?

Scratch that idea.

For several hours he invented and rejected a hundred madcap schemes. With genuine reluctance he decided against building a land-yacht. He had the materials: he could make sails from plastic sheeting. But down at ground level the winds blew every which way. It was only some five hundred feet overhead that the restless billows surged ever eastward . . .

A balloon?

He could heat-seal patches of plastic to make a sphere. There was hydrogen aplenty in the tanks. There were materials enough for a dozen balloons. It would be easy to knock up some kind of a basket, or even a harness . . .

Oops.

The wind blew due east, but Crazy Harbour was *south*east. He would miss by 350 miles.

Can you tack against the wind in a balloon? Morgan was aware of the principle, having spent more than one ground-leave yachting on Skaun Primus. On Secundus the wind was too

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erratic and there were few lakes, but a great many sports were practiced on Primus and Morgan had tried most of them. Now yachts tack by trading off wind-pressure against resistance of the water. No, a balloon would be at the mercy of the wind.

But that wind represented inexhaustible power. How, then, to use it?

There was another sport that Morgan had practised on Skaun Primus. Hang-gliding. He was quite skilled at it.

Surely he could rig a suitable shape using aluminum struts and plastic sheeting, and suspend himself from it by a harness? Unlike a balloon, he would have some directional control by banking the wings. Some vertical vanes might improve stability.

He scribbled figures on a pad. Forty-six miles per hour wind velocity, at forty-five degrees; say thirty miles per hour effective speed . . . seventeen hours. Worth a try.

What about launching it? Down here the winds were no help, and he could hardly build a catapult.

But he could use a balloon to lift it above the turbulent zone.

Morgan hung suspended, feeling sick. The ground was an awful long way down, and it was wobbling about too much. He swallowed hard and paid out the cable. He had agonised for an hour about floating up freely, decided it wasn't prudent, and had to spend a day and a half ripping control wiring from the shuttle and braiding it into cable. Wisps of cloud began to obscure the downward view.

It was better that way.

The wind steadied, and the plastic wing began to billow. He glanced at the tiny inertial navigator that he'd pried out of the shuttle's console. Yup: due east. Overhead, the lifting balloon strained eastwards with the wind. He would have preferred to stay attached to it, but it made the hang-glider impossible to maneuver.

Jane, I'm on my way. I hope.

He cut loose from both balloon and ground. The translucent wing soared skywards. *It's going to work,* Morgan thought.

At that moment a wingtip joint broke, and one corner began to flap uselessly; and Morgan Knutsson de Vere side-slipped, stalled, and went into a flat spin. He had never heard of Lindemann and, even if he had, his glider had no stick to push forward and the rudder was too flimsy to oppose the spin, so the spin continued despite his panicky efforts to prevent it. The turbulent lower winds caught him, buffetting the frail construction violently. He fought to regain control as the ground rushed up. . . .

It took two hours to crawl back to the shuttle, and another to splinter his broken shin and spray it with painkiller from the shuttle's medical chest.

Scratch one means of transport.

Scratch one asset.

Morgan crawled into the cargo-hold early, to rest and lick his wounds.

With his leg broken, he needed to find a less athletic solution. Brainless Morgan thought as he had never thought before, in endless permutations. But the surging power of that upper wind was always at the forefront of his thoughts.

If only those winds were at ground-level. It would be easy to make a land-

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yacht. But the winds were up aloft.

He could hardly build a mast five hundred feet high.

Oh no?

It was two hours past dawn and everything was ready.

Morgan anxiously ran his eye over the results of three days' frustrations and triumphs. He was strapped in a sitting position in the hopper of the manure-spreader. Around him were his provisions and the five cartons of fungicide. On the front was mounted one of the shuttle's landing-lights, several batteries, and the inertial navigator.

On either side of him was a handle, connected by a cable to the rear brakes.

From the front, half a dozen more cables stretched upwards and disappeared into the clouds.

On the upper end of those cables, now hidden from view, was an array of hydrogen-filled balloons, scoop-shaped rather than spherical. Four cables were tethers; the other two altered the attitude of the balloon-sails when tightened or loosened from below.

With a silent prayer to the Saint of Courageous Lunatics, Morgan released the brakes. The balloons bellied in the wind, and the *Honeywagon* lurched across the ground. Within half a minute it had picked up speed and was moving at about fifteen miles per hour, which seemed to be the fastest it would go.

Morgan fiddled with the right-hand lever, and the *Honeywagon* obligingly swung to the right as one set of brake-shoes bit. Grinning, he tried steering left, and the vehicle responded accordingly. It was just like driving one of Old Man Massey's gyrotractors. Oh. Yes, well, the less said about that the better. Morgan was the only person on Skaun Secundus who had capsized a gyrotractor. He adjusted the brakes for a forty-five degree right turn, consulting the inertial navigator until he was satisfied.

Honeywagon rolled across the smooth saltflats of Skaun Secundus, riding the upper winds.

They were far superior to tame kshoggi.

At intervals Morgan consulted maps, and made adjustments to the steering and the angles of the balloons. It took time to get the feel of the controls, and on one heart-stopping occasion he tilted the balloons too far sideways, and they plunged Skaunwards under the pressure of the wind. But of course, as soon as he released the control-cables, they floated gently up again into their original position. Morgan felt very foolish but also very relieved.

By mid-afternoon he had the system pretty well taped. The terrain was flat and the low scrub no obstacle. He could steer well enough to avoid the marshlands, and according to his maps there were no large areas of damp ground between himself and Crazy Harbour. He could stop completely by applying both brakes firmly and tilting the balloons edge-on to the wind.

He stopped for food, and some sleep. His plan called for non-stop travel at night. He only hoped the landing-light worked as well as it had on tests.

Dusk fell and he switched it on. Excellent.

A few minutes later he encountered his first pack of kshoggi, slithering from their daytime lairs in the marsh-bottoms. In the beam of the light he caught

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a sudden glimpse of slick pink hides and jagged rows of glistening teeth. Then with horrible grating cries they scattered in alarm as the *Honeywagon* careened through them. They had never seen anything remotely like it. Morgan whooped for joy. If he stayed awake and upright, the kshoggi were no longer a threat.

For three days he rolled over the desert, terrorizing peace-loving kshoggi by night and sleeping by day. One balloon-sail deflated with a slow puncture, but it scarcely slowed him down and the rest remained sound.

How pleased Fergus Massey would be to see the fungicide . . .

How pleased Jane would be to see him . . .

How clever everyone would think he was.

Brainless Morgan's balloon-powered manure-spreader breasted the last rise as darkness fell. At the bottom of the long, slow slope down to the lakeside he could see the lights of the colony buildings and, on the far right, the silhouette of Old Man Massey's polyfarm.

No more kshoggi: they kept away from the lake. Presumably the change from salt to silt upset their constitutions. Morgan switched on his headlight. This time he *would* show them. When he turned up in *this* contraption, nobody could call him "brainless."

Or could they?

He got no credit for his paintings, panclasmic repressionist masterpieces though they were. He got no credit for his cargo-handling, which was superb.

Would they try to delude themselves that this was the *obvious* way to cross the wild saltflats?

They might.

For the first time since he left the wrecked shuttle, Morgan's confidence began to fade, and his stomach began to sink. They might indeed. They almost certainly *would*. What could he do to prevent that?

And it was then, barely half a mile from home, that Morgan Knutsson de Vere had his *second* bright idea.

Fergus Massey belched happily. Placing his empty glass carefully on the side-table he walked over to the window to draw the blinds.

Odd.

There was a triangular patch of light moving down the slope towards his farm.

"Martha! Something's attacking! Rouse the hands! Get the—"

The rest was drowned by a tremendous crash as Morgan's vehicle missed the gateway and ripped out the southern end of a hen-house. It came to rest at the extreme end of the farmyard, trailing straw and chicken-wire for a hundred yards behind it. Chickens were running everywhere and the commotion was incredible. Morgan had hoped for a more dignified entrance, but this one was certainly effective. He brushed a feather out of his hair and composed himself.

The farmyard lights came on. Hesitant farmhands shuffled towards the strange device. It was a manure-spreader. On the back were five cartons, marked BBX-60 FUNGICIDE in red. On the front—

"Brainless Morgan!"

Then they were all around him. From the corner of his eye he saw Jane, caught half way between adoration and bewilderment. But his main attention was on

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Old Man Massey, who was standing right in front of him with a look of utter incredulity on his face. He saw the fungicide, the unpowered muckwagon, and Morgan.

He didn't see the cables or the balloons, because Morgan had jettisoned the lot a hundred yards out in the darkness, and they were now several thousand feet overhead and five miles away. That had been Morgan's second bright idea.

Without mystery there is no prestige.

Massey found his tongue. "Prancing possums, de Vere, how did you drag *that* thing across the saltflats?"

In Crazy Harbour they still tell the yarn about how Morgan Knutsson Massey de Vere (only he was plain "de Vere" then, you understand), with one leg broken, alone and unaided, crossed five hundred miles of hostile kshoggi-infested saltflats in an unpowered manure-spreader to save the cowcumber crop. And they never have worked out how he did it. An engineer would probably guess, but all the engineers are on Primus: there won't be any engineers on Skaun Secundus for another two generations—unless Linda Strauss got on the hooch again.

Brainless Morgan looked Fergus Massey squarely in the eye, and smiled sweetly. Then he revealed as much as he could ever be persuaded to of his method.

"Brainpower," said Brainless Morgan. ■

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SEEK NOT PROMETHEUS

EDWARD A. BYERS

I didn't make the mistake—he'd have cracked my spine without changing expression—of trying to sneak past Slovik to go up to the lodge. So, instead, I sat upright on the hard edge of one of the laboratory chairs and thought about an Indian I'd known when I was fifteen. *You choose your own oblivion,* Ijira Waden was fond of saying. *You, me, humankind—each in our own way, going willy-nilly to our own dark door, peering within, nodding at shades abiding in that place.*

An adventuresome man, Ijira Waden. He'd done his share of peering within, nodding. And they'd found him one day wrapped around a jacaranda tree, a look of purest terror on his face. I wondered always if he hadn't opened that door too wide, gone too far, seen too much.

I wondered if Ijira Waden hadn't perhaps encountered a Slovik all his own.

The lab window stood open, revealing an oblong square of slowly lessening light; it grew dark quickly in the shadow of the mountain. I stared out past Rowan's tourist lodge, now long unused for tourists, past stands of scruffy underbrush, and felt against my face the leading edge of night currents falling off the slopes.

"Pan."

The voice came out of the gloom, from the intercom over the steel desk. Rowan's voice. Friendly, concerned.

"What is it?" I asked. I rubbed my chin, felt a two-day's growth. Outside there were patches of blackness, widening geometric absurdities that filled crevices and hollows, making of the mountain a thing in mourning. Here, then there, winked silver eyes as the failing light caught the angle of the alloy plaques.

"I thought you would like to know," Rowan said. "Something is happening on the mountain."

"So?"

"I've been listening on the comm net. They're using the Gate."

I grinned in the darkness, pictured Roger Morgan playing God.

Decisions must be based on data. They're hardest when part of the data has been concealed—especially when the decision involves closing off a possible source of more data.

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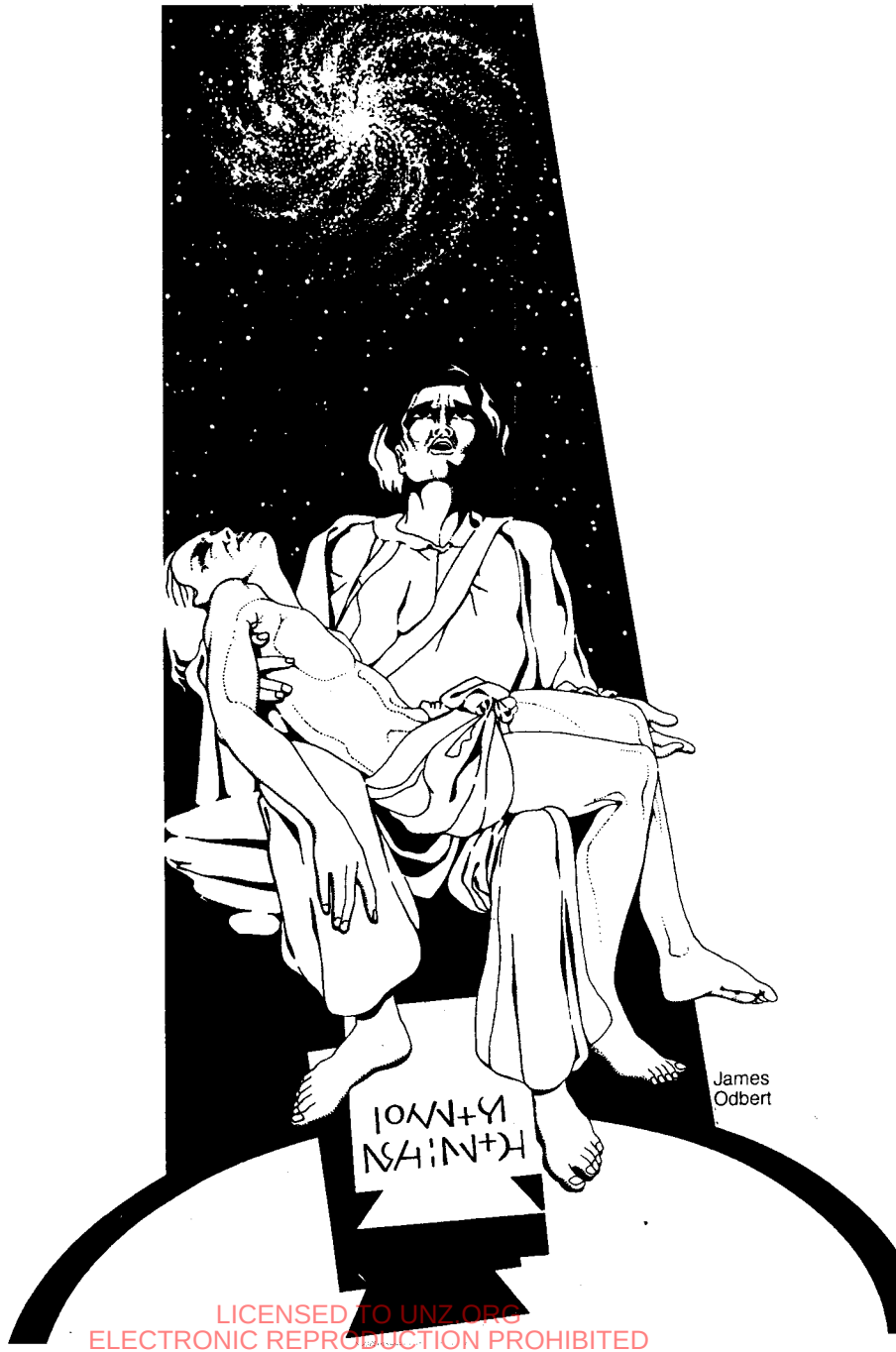

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"Pan?"

"I heard. The man doesn't want to admit defeat. That much is apparent."

"He's not trying to get out," Rowan replied. "This is something coming *in!*"

That stopped me grinning and sent a writhing snake of electricity up my spine. Impossible, I thought, and knew it wasn't.

Damn Morgan! What trick had he come up with?

When I opened the door the creature with Inca eyes twisted around in the shadow and looked at me, then motioned me back inside.

"I want to go up to the lodge," I said.

The thing didn't say anything, only hunched forward in a crouch that made him appear smaller than he was. At my next step he would uncoil, then batter my brains against the sides of the lab.

"Morgan has found something important," I told my guardian. "He won't mind if I watch."

Slovik shook his head. Then he advanced a half-step and my stomach muscles formed a knot the size and shape of a cannonball. Light spilling from the lodge revealed spiky eyebrows, excessively long muscled arms. He'd have been worshipped in ancient times, when stone knives were in fashion. He was a caricature of Man—a genetic devil.

Morgan's watchdog.

I grinned at him, but all the same I took a half-step back and closed the door. I was sweating. I thought: *There is a man up there on the mountain tearing the guts out of me. And there is this thing (call him a man if you will) outside my door to make sure I don't interfere.* And, in some ironic mental admiring whisper, the thought: *He is* exceedingly *good at his job.*

There was some brandy left; Morgan was nothing if not humane. I opened the bottle, found an empty coffee cup, filled it halfway. As I drank I felt a sudden surge of anger, and counted it a good sign. Too long had I felt hollow, neutered.

The anger lasted until the drink was gone. Then I sat down in the chair again and stared out at the approaching night.

Convention has it that Man must take the low road to the stars, traveling at some substantial subtraction of the speed of light. Convention is wrong. Up there on the mountain was a stargate, a point of exodus that an alien race had built, then used to bootstrap themselves the hell away from there.

Talk about your high road.

There were instructions of sorts, on the steel plaques that dotted the sides of the mountain. I'd translated some of them, discovered the code that worked the portal.

There was a hitch, of course—there always is. The aliens had put a lock on the Gate, a screen to keep their enemies from following them. An old teacher of mine named Titus Wilde figured that out, and beat it because he was such a benign old gent.

All of that had happened a long time ago. Seventeen years, a lifetime.

When Roger Morgan had first shown up he asked about Titus, but he used the name Setsen Dai, one of several appellatives Titus had been given in a long life of teaching and study. Freely

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translated from the original, bastard outworld Burmese, the name meant The Shining Light.

There was no hint, that first morning after landing, that Morgan was other than what he seemed, a scholar come to see the portal first hand. His entourage had not yet arrived, would not for another day.

He had a commission from Laerdes, one of the lesser academies, to study the principles of sub-space transfer, whatever that was. But he seemed more interested in Crown Mountain, looking up at it with the same hunger I still felt at times. It can get hold of you, that mountain.

"We don't even know what they looked like, do we?" he asked, glancing my way. "The aliens, I mean, the ones who built the portal."

"No," I said wryly. "They didn't leave statues. The only thing they left behind was the mountain." After a pause I said, "But maybe that's monument enough."

He bobbed his head, understanding. "The mountain," he said musingly, "and its portal. How many have gone through it, Dr. Kirst, since that first day?"

I said, "Three hundred and twelve," and stopped, aware of how sharply I had bitten off the words. The stargate accepted only those drugged enough to elude the sensors—a finesse that resulted, temporarily, in brain numbing autism. There were eight planets in the aliens' network. All eight had been probed. There had been no returnees.

Morgan turned and studied me for a moment, his eyes flickering over my graying shaggy hair, over the frayed collar and tunic shiny with age. If he had harbored any illusions they were shattered before now; he was simply consolidating his findings. But that didn't mean I had to like it.

I said, "I make no apologies, my young friend."

He flushed, then raised his head and smiled in chagrin. "Sorry," he murmured. "It's just that you don't fit the picture I had of you."

"And what might that have been? A tall hawk-nosed recluse whose powers don't dim with the passage of time?"

He nodded. "I'd seen pictures of you, taped interviews. You seemed always so incisive, so *alive*."

"And now you see a ragged old soak," I said grimly.

"Well . . ." he shrugged, embarrassed. Then he grinned engagingly and gave his attention again to the mountain.

There was a brief silence then, until he broke it.

"There's a poet on Laerdes," he said quietly, "who insists that mountains are only slightly lesser gods. He would like it here." He broke off, looked at me briefly, then studied the high bluffs. Almost but not quite he managed to suppress his excitement, his . . . anticipation.

We talked that evening, over brandy and beer and thick slabs of beef, about Titus Wilde and transcendentalism and the manner of things in the universe. Heavy stuff. Heady stuff. Sub-space transfer, it seemed, was a method of short-circuiting something called Stern's Loci, bending the fabric of space back upon itself like a blacksmith with a rubber horseshoe. It was only a theory as

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yet, but it showed promise. And then, of course, there was the portal. It might be that up there on the mountain Morgan would find a working model of his transfer station.

I looked at him. He was short, with fair freckled skin and a shock of carrot-red hair. His eyes were blue, his whole manner open and friendly. It was impossible not to like him. "And if you do find that model?" I asked. "What then?"

He grinned. "No more sleep-ships. Step through at one locus, emerge at another. We'll be able to go anywhere in the galaxy—or in any galaxy."

After three brandies it all sounded reasonable enough. But then what did I know, I'd taken my last physics class ten years before Roger Morgan was born. Still and all, I meshed it through the gears. It took some time.

"It sounds too simple," I said finally. "You try that theory out on anyone else?"

He looked a little less happy. "I read a paper on it," he said after a pause. "At a symposium at the Academy. They were pretty skeptical."

"And so you're here now to prove your case."

He nodded, then refilled his beer stein from a pitcher on the table. His eyes were clear, but something about them troubled me. He had been hurt—and he meant to amend that hurt. Something inside my head went *bong!*

Engarde, mon ami . . .

We lapsed into silence then, our ears tuned to the eternal night song. Gods of wind and mountain fighting their ancient battle. Could be Morgan's poet had a point.

"What if your observations don't prove anything?" I asked finally. "What will you do then?"

Morgan looked up, shook his head as though to clear it. That moaning basso *te guello* takes some getting used to. "I don't intend to fail, Dr. Kirst. If I have to, I will dismantle the stargate piece by piece."

I jerked my head up. He meant it.

. . . te guello . . . te guello . . .

Long after Morgan had gone to bed I remained awake. Thinking. The after-dinner conversation had taken some unpredictable turns, and it disturbed me more than I cared to admit. Morgan must know that if he attempted to dismantle the portal I would stop him. On the other hand, he did not strike me as someone who acted on impulse—he would have a plan. I hoped he would not become an adversary; I'd had my fill of fighting.

"I understand Mr. Morgan's friends will be here in the morning," Rowan said. He was standing just outside the kitchen doors, waiting to clear away the dishes.

"There are three of them," I said. "Keep an eye on them, will you, Ro? Something tells me Morgan is going to require my full attention."

Rowan's eyes widened. "Trouble, sir?"

"Could be," I said.

I've always had a flair for understatement.

"I know about you," Morgan told me at breakfast. "You were a tactician in the Earth-wars. Very skilled. There's a computer file on you at the Academy.

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Typed out, it comes to 116 pages."

There was ham and eggs, and freshly-baked biscuits with new butter. And a carafe of specially blended coffee; Rowan's satisfactions are not mundane. I filled my plate and thought about it and wondered if Morgan had been touched at all by the universe beyond Laerdes Academy.

The war happened. Like countless others it had taken me, used me, thrust me aside. I had killed and I was afraid of killing. I had grown old with killing.

"When are you going up to the portal?" I asked, changing subjects.

He picked up his coffee cup, took a sip, raised his eyebrows appreciatively. "The equipment is coming down this morning," he said. "We've even brought our own floater. We'll start first thing in the afternoon."

"Will you climb or use your floater?"

He smiled. "I know that climbing is the best way, the *alien* way, to view the plaques. And it's recommended in all the guide books. But it's the kind of ritual I can do without—I'm only interested in the portal."

"The two are tied together," I said. "The plaques provide the patterns for the Gate."

Morgan looked at me between bites of ham. "I brought along slave units. I'll attach them to the plaques and set whatever pattern I choose up at the portal." He shrugged. "I'm surprised you hadn't already thought of it."

"I had," I said. "It seemed . . . too mechanistic."

The grin again, boyish, friendly, easy to underestimate. "You're an anachronism, Dr. Kirst. Time has fled you by. I get the feeling you want the mountain to remain just as it is, forever."

Close, but not quite true. The mountain and I had grown to know each other, our moods, our seasonal vacillations. Leopards both, whose spots can change. The mountain was an honored adversary. I wanted to understand it, to dignify it . . . *and dignify myself, perhaps, thereby.*

"You can use the slave units," I said. "But don't even think of dismantling the portal. You'd have to cut it apart with torches to do that . . . and what if you were wrong?"

He shrugged. "Then I would find out where I was wrong. Are you sure you won't change your mind? Observations may not be enough."

"I'm sure," I said.

Morgan glanced at his watch, pointed overhead, gave me a hesitant grin. "We can talk about it while we're off-loading our gear. Why don't you come along, meet my associates?"

I shook my head. "I'll be in the laboratory. But bring them by. We'll have a toast to your success."

"Fair enough." He rose and gave me a mock salute, then turned and exited through the lodge door.

The laboratory was squat, ugly, part of it built on stilts, part of it buttressed against the slope of the mountain. I'd built it in years past, added to it as needed. I'm told it reeks of fog and rain and something indefinable. The smell, perhaps, of eons of time. It's there in the plaster casts and hewn stone and ancient scratchings that make the aliens one with Man.

I was thin-slicing a fragment of petroglyph when the gravel crunched out-

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side. It was idle work, habit only. A moment later Morgan put his head in, then ushered in his colleagues. I got impressions of brownness and blondness. They were young, probably students. There were two of them.

"Shields," one of them said.

"Finney," the other one said.

I put down the petroglyph and got out the bottle of ten-year-old brandy. As I doled out the liquor I shot a look at Morgan.

"I thought there was another one."

"There is," he said, nodding. He took a ritual sip of his drink and sat on the cleared edge of a table. He seemed to have lost the grin somewhere. "Do you remember," he asked after a moment, "that computer file I put together on you?"

I nodded.

"Well, it made you out to be pretty formidable." He looked at me as though he'd come to other conclusions. And, given the circumstances, I couldn't blame him. He tried the grin again, gave it up. "All the work you've done here, translating the glyphs, your war record, your whole reputation—" He stopped and let his eyes rove around the lab. Finally he continued. "The computer said you were smart, Pan. Too smart. It said you would find a way to stop me if I tried dismantling the stargate."

I set down my glass, didn't say anything. It was his game.

"Will you give your word to stay out of it?" He looked at me, eyes pleading.

"No."

"I didn't think so." He stopped and took another sip. "It's a pity. Because the computer coughed up a lot else. Your family tree back to the first twig, your schooling, your first peccadillos." He paused and took a breath. "It gave me a complete psychological profile on you. Clear back to the cradle."

"So?"

He gave me a blank stare and shrugged. "I took that information and built a neutralizer out of it. I hired a person at the genetic center to program some DNA, and I grew the fetus to maturity in an experimental rapid-growth chamber. I made a golem."

I picked up my glass again, knocked the brandy back. I tasted nothing, felt nothing. "And where is it?" I asked. "This idiot *doppelganger* of mine."

"Outside," Morgan said. He stood up. He wasn't looking at me anymore. He picked up a petroglyph, put it back down. "His name is Slovik," he said. "And as long as you don't interfere with our operations, he won't bother you."

"And if I do?"

He shook his head. "Don't. He's a compendium of all your childhood fears, your terrors, your private phobias. I've been told the calculus is exact." He paused and glanced up. "If you want to know the truth, he even scares me."

He was coming for me, clenching his fists, face the color of old pennies. Damn you, Morgan—call him off!

I sat up straight in bed, sweating, furious with myself.

I picked up the phone, dialed.

"Morgan . . . ?"

"This is Shields."

"I want Morgan!" I gripped the instrument too tightly; it was slippery with sweat.

"What is it?" a voice said. It was Morgan, his words slurred with sleep.

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"You know what—Slovik!"

"Oh," there was a stifled yawn. "Don't bother him, he won't bother you."

"Goddam you, Morgan! You've had seven weeks up on that mountain. Haven't you found out *anything*?"

"Sure. We found out observations aren't getting us anywhere. We'll have to cut. I know, I know . . ." he overrode my protest, "I promised that would be a last resort. But the sooner we dismantle the Gate the sooner we'll be out of your hair. Think about that—I'll leave it up to you."

I thought about it.

"Don't cut," I said.

"What about Slovik?" Morgan asked into the following silence.

"Lock him up somewhere."

Short and emphatic. "No."

"Thanks," I yelled, and slammed the phone down. And sat. And after a while reached for the brandy bottle.

Outside, it was dark. Up on the mountain things were happening.

I said, "What's going on, Ro?"

"I don't know, sir. They've cut themselves out of the net."

Damn!

Fifteen minutes later Rowan said, "I have them on the telescope monitor, Pan. They're coming down."

"Can you see anything?"

"Too dark. All I see are floater lights."

"Okay," I said. "Get Morgan for me as soon as he comes in."

"Yes, sir."

I waited, my mental clock ticking away seconds. It takes a floater maybe five minutes to negotiate 10,000 feet. Give Morgan's crew another five to walk from the dock to the lodge. There was plenty of time for another coffee cup of ten star.

After seven minutes the intercom sputtered into life.

"Pan!"

"What?"

"They're just getting out of the floater. *Sir, it's Titus—he's returned!*"

"You don't look at all well," Titus Wilde told me some minutes later. "Isn't Rowan feeding you properly?"

Despite the seventeen years since his disappearance, Titus had not changed at all. He was slightly built, gnome-like, with a close-fitting cap of white hair. His eyes were deeply hooded. In years past he had been my teacher, my mentor—my best friend. He was, in fact, charismatic—many regarded him as saint.

But where does even a saint go *not* to age seventeen years?

I said, "Hello, Titus. It's been a while."

We found chairs and sat. We were in the lodge, fire burning cheerily on its hearth, tankards of ale before us, something soft playing in the background. J. S. Bach, I think. This once Morgan had relented. Slovik's purview was extended to include the lodge.

"Mr. Wilde refused to say anything until he saw you," Morgan said. He took a sip of ale and hooked a leg over the arm of his chair.

I looked at Titus. "You've met the aliens?"

He nodded, picked up his own drink, studied the brown liquid for a moment, then put it down. He said, "They have

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several portals like this one, Pan. The universe is a big place, and they have a yen for travel."

"Oh? What are they like?"

"Big. Furry. Long-boned. Much as you pictured them in your imagination." He gave me a smile and sipped at his drink.

"Have you come back as their ambassador?"

"Not exactly." Titus's young-old face registered a kind of ironic amusement. "Seventeen years is a long time, Pan. I came back because I wanted to hear human voices again."

"And to put up the plaque," Morgan put in. He grinned when my eyes widened. He liked surprises.

"Yes, there's that," Titus said. "The aliens asked me to place a plaque for them while I was here. A kind of capstone, you might say."

"Where is it?"

"At the portal. Morgan and his friends have agreed to move it for me—it's too heavy for a single man."

"And, speaking of portals," Morgan interjected smoothly, "what can you tell me about the principles underlying them?"

"Not very much, I'm afraid," Titus said, laughing. He folded his arms and relaxed, his face serene, owlish with wisdom. The years fell away. It was good to have him back.

"Morgan has a theory," I said, and then shut up and let Morgan take over the conversation while I listened and drank my ale and took mental notes. The rest of the evening slid away from us, full of eager talk about transfer stations, furry aliens, and limitless space. I saw that Titus had caught Morgan in his charismatic fold, as he had once caught me.

Shortly after midnight, when the fire had burned itself out and the ashes gone from black to gray, Morgan told Titus what he was planning to do with the stargate.

"Dismantle it?" Titus asked. He raised his eyebrows and stared first at Morgan, then at me. He caught the sense of discord and pursed his lips. "You're allowing this, Pan?"

I grunted, drained my mug. "Not by choice," I said, and told him about Slovik.

We fell silent, then, until Morgan got up and stirred the ashes. I shivered. It was getting late, getting cold.

"When will you be leaving?" I asked Titus.

He said, "In a day or two," and then he smiled. "That is, if Roger will delay that long in dismantling the Gate."

Morgan put away the poker and sat down. He gave Titus a sharp glance full of question marks. "Pan has said he'll stop me if he can," he said. "I believe him. How about you—where do you stand?"

I stopped lighting a cigarette and waited. It was a very good question.

The little mystic considered it, said finally: "As far as I can see you're doing nothing to actually harm him. In fact, the humility may do him some good." He grinned a little, drawing Morgan into his aura. "I won't interfere, but I *will* remind you . . . Pan is a tactician. Press him too far and he'll find a way to beat you."

Morgan gave a little dismissive sigh and finished what was left of his third tankard of ale. And I sat, and stared at

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The Shining Light, and wondered what I was missing . . .

When I awoke in the morning I remembered back, saw the sweat-soaked sheets, knew Slovik had spent the night pursuing me. I looked out the window, saw his stick-like silhouette against a granite cliff. Momentarily I wished I had a high-powered rifle with a 20X scope, but then the thought came to me . . . *what if I missed? Oh, God! If I missed* . . .

I was stepping out of the shower when Titus called through on the intercom.

"Morning, Pan. How about having breakfast with me?"

I toweled myself and grunted. "It will have to be here in the lab. Morgan's familiar will have *me* for breakfast if I try to leave."

"Very well. Sausage, scrambled eggs, toast and coffee. Toast on the dark side but not burned. How does that sound?"

"That will do nicely," I said.

Fifteen minutes later we were sharing a meal on the uneven top of the laboratory table, gazing out at the dizzying sheer cliffs of Crown Mountain. Titus had had a good look at Slovik on the way down from the lodge, but his only comment had been a fractional lift of his shoulders.

I buttered a slice of toast and said, "Is Morgan right? Are the portals subspace transfer points?"

"I don't know," Titus said. "It's possible. But the actual construction of a stargate is several orders of magnitude beyond Man's capability."

"Even if Morgan is successful in dismantling this one?"

The little mystic shrugged, started a reply, then jerked his head around. There came a rattle of stones, brief, surreptitious. He looked at me. "Slovik?"

"Yes," I said. I was sweating again, though the morning was cool.

Titus put down his fork and looked at me soberly. "Sorry to sound tactless, but there's something inherently ironic about the outworld's leading tactician being held in thrall by a bogeyman. I hope you can appreciate the black humor of that."

"Sure," I said. I gave him a pasty smile. "I'm splitting my sides."

He took a sip of coffee, put the cup down. "I meant it when I said I wouldn't interfere, Pan. This struggle is between you and Morgan."

"Aren't you concerned he might destroy the stargate?"

A head shake. "No. Not much." Then his expression of nonchalance flickered for an instant, and I sensed beneath it a warmth remembered from past associations. Part of his charisma . . . he really did care. That was why I loved the man. But then why, I wondered, was he working so hard to conceal it.

He finished his coffee and stood up. He gave me a severe look. "The portal, the mountain—all of this," he said, waving his hand to take in half the continent, "doesn't mean to me what it must mean to you. You've made it your career, your life."

"Morgan wants to take it from me," I reminded him.

"Then fight him," Titus said, and peered out the window in the direction of the sounds. "But Pan . . . be prepared to lose sometime. Nothing goes

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on forever."

"Sounds like an epitaph," I said, and poured myself a second cup of coffee.

Slovik didn't like Brahms. I spent the day playing Brahms.

Spite hath no fury. . . .

Morgan announced himself stumped that evening, his gaze off in the twilight, his eyes not meeting mine.

"We're going to start dismantling it tomorrow," he said. "I'm sorry."

It would have done no good to hit him. Behind Morgan stood Shields and Finney, eager shadows. They wanted action, and a brawl would suit them fine.

"Maybe you're missing something."

"Maybe not, too." He flicked me a glance that said he had sidestepped as much as he was going to.

"It means that much, does it, being able to go back and rub their faces in it?"

He flushed, but didn't say no. And then they were gone and I heard the wind rustling up on the mountain. Their mountain, mine no longer.

When it was fully dark I poured myself three stiff fingers of brandy and sat by the window. I sat, and watched the heavy darkness where the lodge was, and the heavier darkness beyond that was the mountain.

Titus came down from the lodge an hour later. I turned on the lights and he sat on the unmussed edge of the army cot.

"I wanted to say goodby now," he said. "I'll be leaving at first light."

He sat in relaxed silence, and his smile, when it came, was fleeting. End of a road. I knew that when he went through that portal I would never see him again. The sense of loss was suddenly overwhelming.

I swirled the brandy around in my glass and tried to think of something lighthearted to say. Something else came out instead.

I said, "Stop him, Titus. Please."

He looked at me, startled. Then he shook his head. "No, Pan. I'm an outsider. This is between you and Morgan."

It was as I knew it must be.

Hell!

The gravel crunched . . . he was creeping up on me. I lay paralyzed, heart pounding. Unpitying he came, hair like black hemp . . .

I awoke then, and the darkness fell back a little. I turned on the lights, looked at the clock, lit a cigarette. Four hours until dawn.

I spent one of them putting together the shards of a petroglyph. Under the magnifier it was easy, just like putting together a jigsaw puzzle. Then I stopped and had another cigarette and thought about another kind of puzzle altogether. Not so easy, this one—the pieces were locked up inside my head.

The answers didn't come suddenly, but they came. The stack of cigarette butts had grown into a small pyramid and the night was a lot older. I sat staring into my hands as though I'd never seen them before. It was like being hit by a hammer.

The first answer was simple, straightforward, much as I might wish otherwise. Morgan was right; I was wrong. My ambivalence in reacting to him underscored that truth. I had had years to

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study the stargate, yet I had not discovered its method of function. I had left the mountain as I had found it, content in its mystery, helping to build the legend that surrounded it.

The second answer wasn't so simple, nor so sure. And it required doing something I didn't want to do, maybe couldn't do . . . *fight Slovik.*

There is a word for how I felt . . . *terrified!*

It was still dark outside, though there was grayness in the eastern sky. Light from the open windows pushed back the shadows, illuminating the immediate area.

I stepped outside and to my right, keeping the building at my back. My stomach muscles were in a vise, and I couldn't stop my hands from shaking. I saw a gray blur move between two rocks, step suddenly out into the light.

We stared at each other, Slovik and I.

In my right hand, folded, was a weighted net. Hung down my back was a leg off the laboratory table. I took a step away from the building, my eyes carefully on his middle. If I met those eyes I was dead.

He waited until I had taken a second step and then he sprang at me.

It happened too fast for me to use the net. I ducked, fell under him, rolled. I came up fast, hurling the net as I turned.

He was already in the air, arms extended, fingers clawed and reaching . . . *oh god . . . oh god!* The mesh fell over him then, but only partially, leaving one arm free.

I ducked again, rolled left. He was tearing at the netting, strands of rope popping like champagne corks. I tore the table leg free, brought it down, smashed it against the side of his head.

It hurt him. He looked at me through the net's webbing and I knew fear that no man should live with. Hell must surely be filled with such as he.

I brought the club down again and he caught it this time, using his free hand. He ripped it from my grasp and hurled it into the darkness.

He said, "Pan-n!"

There was a rock there, big around as a small suitcase. Under normal circumstances I could not have lifted it, but circumstances were not normal. I raised it halfway over my head, sent it crashing down.

Slovik grew still. He didn't look at me anymore.

I leaned then against the side of the lab. Reaction slapped at me, turned my muscles into jello. I felt my insides turn over, and I emptied up my breakfast back to the previous Tuesday.

When I felt well enough I followed the path up to the lodge, the sound of my footsteps on gravel curiously reassuring. The gray light had turned to pearl with a touch of green. There was no sound but the wind.

Rowan was awake, his kitchen bright with light, his coffee perking, his mixing bowl full of waffle batter. He looked up when I came in, did a double-take, and stood there grinning.

"You beat him." Like he'd known it all along.

I said, "It was a close thing. Where is Morgan?"

"Sleeping. Breakfast isn't for an-

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other half hour."

"And Titus?"

"You just missed him. He's gone—up to the portal."

I turned then and sprinted, out of the lodge, up toward the floater dock. There was one dark mound there where there should have been two.

Thirty seconds later I was rising, lights off, up the side of Crown Mountain. It was tricky, a little; the winds kept wanting to smash me into stone overhangs. I fought, though, and lifted, my eyes on the pearl nimbus at the mountain's top.

I brought the floater over the top of the plateau too fast, overshooting the landing dock. I countered for it and switched on the lights. I had time enough to see Titus standing above the stargate and then no time at all. The floor of the plateau came up with a rush, the other floater directly in my path.

I struck and the world went dim for a few seconds. When it had cleared again I got out of the floater and stood there, watching Titus climb down from his perch.

"That was one hell of a landing," Titus said. He dropped the final few feet and peered at me. "You do know you'll have to walk down, now."

I realized he thought I was Morgan. I took a step forward, so that one of the landing lights pooled at my feet. I said, "Hello, Titus."

"Pan!"

"Don't tell me you're surprised."

He came close, touched me lightly on the arm. He gave me a worried look, then one of admiration. "Of course I'm surprised. But congratulations. I truly thought Morgan had defeated you."

"He *had*," I said. "Totally. Unequivocally."

"Then how . . . ?"

I laughed harshly. "Morgan was only going to destroy the stargate . . . you intended to *destroy* it." I pointed to the niche above the Gate. In the growing light there was a faint metallic glimmer. "Is that the plaque the aliens asked you to place for them? The capstone?"

"Yes."

"Let's go look at it. I want to see what it says."

He stood without moving, assessing me. Then he relaxed and permitted a faint, ironic smile. There was pain in it. For both of us. He said: "What for, Pan? You already know what it says."

"That the aliens don't want us." It hurt, saying it.

He nodded. "Not verbatim, but close enough."

A sadness descended, like a balloon. "And that was why you weren't concerned when Morgan said he was going to dismantle the portal. You were going to destroy it permanently, before he had the opportunity."

"That's right."

I stared at him. "It's set now, isn't it? All you have to do is step inside, activate the portal."

He didn't answer, but he didn't have to. I looked above him, at the spears of light bouncing off the tops of the mountains. The aliens had come back after all, across the lightyears, down the centuries. They had looked and found us wanting. And sent their emissary, this poorest angel of their Olympia, to close the marble doors.

To hell with you, Jack!

Titus shuffled his feet. "Never match

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wits with a tactician," he said ruefully, then gave a little shrug. "Will you try to stop me, now?"

"I'll stop you," I said.

"Why?"

"You said it yourself . . . you're an outsider. You would deny us . . . the stars."

We stood still in the midst of growing light. There were shadows, though, to hide our faces from each other. Reluctant participants both. Saint and sinner.

He moved back and fell into a crouch. I had learned martial arts from him in the dim days when I was a student. I had never beaten him.

He said, "I'm sorry, Pan."

"Me, too."

* * *

Afterwards, in the cold light that presages day, I sat with his head in my lap and watched as the shadows melted away on the slopes. There was sudden movement there, a bloodied head that rose and fell and came on very fast.

What if, I wondered, after all, he had been right? Maybe Man was not yet ready to join those . . . others. Perhaps Man is the alien . . . eternally . . . alien even to himself. I wasn't sure, but . . . *goddam* I wasn't *not* sure. There was a leaden feeling in my gut.

Up on the mountain the only sound was the wind.

And I sat there, in the growing light, and waited for what was to come. ■

● Once in a great while a story comes along which is so striking in concept and execution that it immediately engraves itself in readers' minds as the definitive approach to its theme. Such a story was Isaac Asimov's "Nightfall," which appeared here almost forty years ago and introduced the idea of a world in which darkness and the stars were visible only once in a thousand years. Until now, as far as I know, no other writer has attempted to do anything new with that idea.

But one of the earmarks of a really good idea is that it is so full of potential that it can be explored over and over, each time from a different angle and with a fresh set of eyes, and continue to yield something new and valuable. Impressive as "Nightfall" was, in 13,000 words it could barely begin to explore the ramifications of that kind of a world. How could that situation really come about? What kind of culture would develop on a world where generation after generation never saw night? What would really happen to a member of that culture who dared to question its most basic precepts?

Dean McLaughlin has been thinking about such questions in depth for several years. The result is *Dawn*, which we begin serializing next month, with illustrations by Jack Gaughan. Here you'll meet a fascinating culture-that-might-be, a scientist in the midst of a fundamental breakthrough, the birth of a new religion with a somewhat reluctant prophet, and much more—all very vivid and real. Yes, this world is similar to that in "Nightfall," but beyond that it goes its own way. I wouldn't offer it to you if I didn't consider it fully capable of standing on its own in such company.

It is. I think you'll like it.

IN TIMES TO COME

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THE ALTERNATE VIEW

IT'S A BIG PLANET

G. Harry Stine

The "Brass Tacks" letter of V.W. Terrill in the October 1980 issue warmed the cockles of my heart because I, too, have believed for many decades that far too many SF authors have narrowed their stories by a lack of realization of the sheer *size* and *complexity* of even a small planet such as Tellus (ofttimes known as "Earth," to those who insist on calling our planet "dirt").

Our fathers a mere half a century ago didn't suffer from the delusion that Tellus is a small and fragile place. I myself can remember when it took two days and nights on a train to travel from Colorado to New York City . . . and that was the *fastest* way to get there, the airliners of the time not being reliable all-weather aircraft and air fares being even higher in terms of real dollars than they are today.

Today, people blithely walk aboard an upholstered metal cannister known as a "wide-bodied jet airliner" (and also called a "flying cattle car") without even venturing out of the terminal building. During a five-hour flight from Los Angeles to New York, it's hard to see Tellus at all save for the glaring white tops of the clouds far below. Even a transatlantic journey is only a seven-hour entrapment aboard a 747, while our parents, if they could afford it, required four days to make the same journey on one of the Cunard *Queens*. At one's destination, one debarks from the flying cattle car into another, similar terminal without even once being exposed to the weather.

It's no wonder that some science-fiction writers, SF readers, and rampant environmentalists have the general concept that Tellus is a small planet. Being small to their minds, the planet therefore seems very fragile and easily damaged, changed, explored, conquered, or whatever.

Oh, yeah?

I felt that The Editor's reply to the Brass Tacks letter was apropos because he and I share a common syndrome: We're both general aviation pilots who've seen the United States from the lofty perch of a Piper or a Cessna blazing along at 135 mph about a mile above the corn fields, the junkyards, and the clotheslines of America.

I just completed my fourth transcontinental flight in my Cherokee-140, which is about as small an airplane as you'd want to fly across America. It has a single engine producing a roaring 150 h.p. and swinging a big metal fan called a propeller (remember them, Dad?). It'll carry two people (four if they're small and don't want to go very far) and about a hundred pounds of baggage at

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a blistering 135 mph. It won't climb higher than about 12,000 to 13,000 feet.

On the eastbound flight from Phoenix to Boston for the Noreascon (1980 World Science Fiction Convention), Rick Sternbach came along for the ride. It took two days and about twenty hours of flying. We stayed overnight in the St. Louis area. Stops were made about every four hours not only to refuel the airplane but also because the restrooms in a Cherokee don't work very well; in fact, they're non-existent except for an old coffee can which I keep under the seat for emergencies.

The Planet Tellus is not only a big place but that small part of it known as the United States of America is big, too, when seen from an airplane at 5000 feet going 135 miles per hour.

I counted at least twelve biomes, and there were probably more. In the course of the first day, we went from low Sonoran Desert to high Chihuahuan Desert to the mesas of New Mexico and the Texas panhandle to the red farmlands of Oklahoma to the neat green farms of Missouri. The next day, we flew over more farms and more farms and more farms and the Allegheny Mountains and Three Mile Island and the New York suburban complex and the deciduous forests of New England. The visibility went from about 200 miles west of the 100th degree of longitude to zero in the humidity-laden air of the eastern U.S.A. We flew along the cloud tops, leading Sternbach to remark that it was probably like flying along the upper atmosphere of Jupiter.

Except for the brownish band in the clouds at 7000 to 9000 feet (caused by ragweed and other plant spores floating in aerostatic equilibrium in the atmosphere), we saw little evidence of pollution. Save for small areas in the Appalachians where there was evidence of strip mining *if* you looked for it and knew what it was, the forests and farms and meadows were green and lush and beautiful.

I remarked to Sternbach, "Yeah, we're sure screwing up this planet's ecology, aren't we?"

Something else occurred to me as we were flying along above the broken clouds over Ohio with nothing to see in all directions but lots and lots of environment.

For all intents and purposes, we could have been two aliens who'd just descended from an orbiting Mother Ship, charged by the Galactic Overlord with the task of exploring Tellus in the next few days.

Sure! You bet!

Baloney! Or worse.

Generations of humans have been exploring this planet for 5000 years or more. We may have a pretty good handle on about 28 percent of its surface, but we've just begun to explore the remainder that's covered by water in large amounts. And we really don't know too very much about the 28 percent that we've already explored.

When you really get right down to it, I suspect we know about as much about the Moon and Mars as we really know about Tellus.

Granted that the primary task of science fiction (and other forms of literature) is to *entertain*, it's also shown an amazing propensity for compassionately considering future options. However, permit me to ask the legitimate

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question: Has SF unduly *restricted* the future options it's considered because of a highly biased world view? Save for a few SF writers whom I could count on the fingers of both hands (I'll let you try to guess their names as a little exercise), most SF yarns are written with a Euro-American cultural background usually centered on an urban area such as New York City or Los Angeles. This is a restricted world view because, as Rick Sternbach, Stan Schmidt, and I know from flying around, the world is far from being covered with people, concrete, superhighways, smokestacks, garbage dumps, strip mines, air pollution, automobiles, high-rise apartment buildings, or other artifacts of a high-tech civilization. The world is mostly open space covered with gobs of living things with the exception of *homo sapiens*, who seems to be jammed together in conurbations. Dr. Robert W. Prehoda is correct: the world is suffering *only* from a series of localized Malthusian crises.

When one sees the immensity of the plains of Missouri, Kansas, Nebraska, the Dakotas, Oklahoma, and Texas, or the vast expanses of the American West, or the lonely stretches of West Virginia's mountains, or the hill country of Ohio and southern Illinois, one begins to realize that this planet is a pretty big place. Those who believe that the human race can destroy it with technology-gone-wild have more faith in the power of technology than do the technologists themselves.

Westbound on my return, I flew for ten hours from Dayton, Ohio to Pueblo, Colorado. I kept thinking what it would've been like 130 years ago to *walk* the same path I flew over.

Mind you, I'm not suggesting that every SF writer, futurist, futurologist, ecologist, environmentalist, or reader fly coast-to-coast in a single-engined general aviation airplane. It's more comfortable to go by jet. But I do think that people involved in SF, science, environmental conservation, and forecasting would do a better job if they'd see more of their native planet and its people in some perspective other than the high-tech manner in which almost everyone who travels today sees it.

The current concern about the planetary environment is not shared by other peoples around the world who happen to live in a low-tech or even ancient culture. And it's not the result of the photographs made during the Apollo lunar missions. It derives from the simple fact that the world appears to be covered with concrete and people when you ride the center seats of a wide-bodied jet airliner.

For decades, aeronautical engineers have decried the non-availability of a "DC-3 replacement," a small airliner that would fly low, slow, comfortably, and economically. (The DHC-6 Twin Otter probably comes closest today.) I, too, decry the lack of such an airplane because its unavailability deprives us of a valuable way of seeing our planet.

Our planet is a big place . . . much bigger than we are.

And you have to rise a little bit above it in order to get the perspective to realize this.

What we lack most today is something our educational system has failed to instil in us: a sense of perspective of time and space. ■

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Rudy Rucker

Good research is a matter of asking the right questions—and there may be bizarre penalties for asking the wrong questions.

SCHRÖDINGER'S CAT

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"A cat is placed in a steel chamber, together with the following hellish contraption (which must be protected against direct interference by the cat): In a Geiger counter there is a tiny amount of radioactive substance, so tiny that maybe within an hour one of the atoms decays, but equally probably none of them decays. If an atom decays then the counter triggers and via a relay activates a little hammer which breaks a container of cyanide. If one has left this entire system for an hour, then one would say that the cat is still living if no atom has decayed. The first decay would have poisoned it. The wave-function of the entire system would express this by containing equal parts of the living and the dead cat."

—Erwin Schrödinger, 1935.

By rights this should have been an important scientific paper . . . not a thrilling wonder tale in some lurid, mass-produced digest. But I must cast my net as wide as possible. I am fishing for minds, minds with the delicacy of thought to appreciate the nature of Ion Stepanek's fate.

Such are the facts: With my assistance, Ion Stepanek was able to build a sort of time-machine. He used this machine to produce a yes-and-no situation, which he tried to observe. As a result, he has split into an uncollapsible mixed state. Due to coupling effects, I also suffer his condition, though not yet to the same degree.

It is March 21, 1980, Heidelberg, West Germany. I am sitting in the office Stepanek shared with me, staring out at a white sky. The office is in the Physics Institute. Across the river, the great castle hovers over the misted town like a thought. Such are the facts.

I did my undergraduate work at Stanford, then took my Ph.D. in particle physics at Berkeley. My thesis project helped lead to the first experimental disproof of the Bell inequality. At the time this was a fairly sensational result, although now more and more people have accepted the ultimate validity of the wave-function world-view.

Schrödinger's thought-experiment is paradoxical because, according to quantum mechanics, until the observer opens the door, *the cat is not definitely dead or definitely alive*, but is rather 50 percent dead and 50 percent alive. The cat is in what is known as a *mixed state*.

Einstein responded to Schrödinger's paradox by asserting that this fifty-fifty business was just a measure of the observer's lack of knowledge, rather than being a true description of the actual state of the cat. But the experimental disproof of the Bell inequality has shown that Einstein was wrong. The unobserved world evolves into truly mixed states. There are no hidden parameters which make things stay definite.

It is thanks in part to my own research that this result was proved. But despite this high achievement, I was unable to obtain a good research or teaching post. I make enemies easily, and it may be that one of my letters of recommendations was, in effect, a black-ball.

I postponed the inevitable with a post-doc at Harvard. But after that I had to take a poorly paying job at a state college in Wankato, Minnesota.

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Cut off from any real physics laboratory, I was forced to begin thinking more deeply about the experiments I had run at Harvard and at Berkeley. What is it Schrödinger says about his paradox?

"*This prevents us from accepting a 'blurred model' so naively as a picture of reality. By itself reality is not at all unclear or contradictory. There is a difference between a blurred or poorly-focussed photograph and a picture of clouds or fog patches.*"

I had a nervous breakdown during my fourth year at Wankato. It had to do with the television weather reports. Quantum mechanics implies that *until someone makes an observation,* the weather is indeterminate, in a mixed state. There is, in principle, no reason why it should not be sunny every day. Indeed, it is logically possible to argue that it rains only because people *believe it to be raining.*

Fact: In Wankato, Minnesota, there is precipitation 227 days of the year.

Before too long I thought I had determined the reason for this. All of the citizens of Wankato . . . even the faculty members . . . watch television weather reports every evening. These reports almost always predict rain or snow. It seemed obvious to me, in my isolation, that if the weather reports could be stopped, then it would not rain so often.

I tried, unsuccessfully, to gather signatures for a petition. I went to the TV station and complained. Finally, I forced my way into the studio one evening and interrupted the weather report to state my case.

"Tomorrow it will be sunny!" I cried. "If only you will believe!"

The next day it was sunny. But I was out of a job, and in a mental institution. It was clear that I needed a rest. It had been folly to hope to shift my fellows over so abruptly from one belief system to another. I had neglected the bridge, the mixed state.

That was in March, 1979. A year ago. They let me out after six weeks of treatment. As luck would have it, a letter from a German research foundation was waiting for me when I finally got back to my little furnished room. They had approved my application for a one-year grant, to be spent working with Ion Stepanek at the Physics Institute of the University of Heidelberg. My project title? "Mixed States as Bridges Between Parallel Universes."

On a typical Heidelberg day it is misty. On the Neckar river the vapor hangs in networks, concentrated at the boundaries of atmospheric pressure cells. The old town is squeezed between the river and a steep mountainside. Some hundred meters up the mountain hangs the huge, ruined castle. In the mist it looks weightless, phantasmagoric.

I got there early in September, during semester break. I found a room outside of town, and on most days I would ride the stuffy bus from my apartment to Bismarckplatz, the little city's center.

Strange feelings always filled me on these busrides. I never seemed to see the same face twice, and the strangeness of it put me at a remove from reality. Never had I tasted alienation in such a pure and unalloyed form.

Half-convinced that I was invisible, I would stare greedily at the German women, at their thick blonde hair and

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their strong features. The women stared back with bold and clinical eyes. I gave my heart a thousand times, without ever saying a word. But I could never muster the courage to approach one of those tantalizing aliens. I am, after all, soft and funny-looking.

On a normal day I would get out at Bismarckplatz and walk over the bridge. Crossing the Neckar always took me a long time. In the middle of the bridge I would stop and watch the fifty-meter-long barges speeding by beneath me. The river is like a highway, with coal and wrecked cars being lugged upstream, and great beams of steel gliding downstream. There are the locks to see, and the hazy old town and, above it all, the great hallucinatory castle.

Other, darker, thoughts detained me on the bridge as well. Surely you have seen Edvard Munch's painting, "The Cry?" Why do you think Munch chose to place this most anguished figure in modern art . . . on a bridge? On a bridge one is neither here nor there, one is rootless . . . and anything can happen. Did you know that in the 1800's the most commonly attempted method of suicide was none other than . . . jumping off a bridge? Out there, in the wind, one need not choose this bank or that. There are other alternatives.

During my first two months in Heidelberg the Institute was deserted. The sole secretary present showed me my desk in Ion Stepanek's large office. As I later learned, Stepanek was spending the semester break visiting relatives in Budapest. Both he and his wife Klara were Hungarian refugees.

The first time I met Stepanek, he caught me by surprise. I had spent those first lonely months at the Institute by going over various treatments of the Einstein-Podolsky-Rosen paradox. My slow understanding of the solution was expressed in a large, three-dimensional figure, a sort of solid letter "Y" which I was amusing myself by drawing on the office blackboard.

"William," a voice cried suddenly. "What a pleasure to find you here, hard at work!" I turned around a bit too abruptly—he had startled me—and we shook hands.

Ion Stepanek was a short, wiry man, given to wearing suede vests and jackets. His hair was thinning, and rather greasy. He had a large nose and a wide, amused mouth. His eyes were very quick, and he had a disconcerting habit of staring me in the eye when he sensed I might be holding something back.

Although he was ten years my senior and, nominally, my supervisor, Ion began by treating me as an equal. He had read my experimental work and my recent, unpublishable theorizings. In return I had read everything he had written, even including a stack of freshly typed pages I had found on his desk.

His sharp eyes took in my diagram of the EPR paradox, and then he turned to gesture at the window. "So, William? Do you like the fog? The indeterminacy?"

I shrugged. "I can live with it. Did you enjoy your vacation?"

"Must it be yes or no?" I didn't know quite what to answer. Stepanek savored the moment, then clapped me on the shoulder. "Have you read my latest?"

"You mean this?" I pointed to the

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stack of pages on his desk. "Yes, I took the liberty. But . . ." I stopped, not wanting to offend him.

He plucked the thought out of my eyes and answered it. "You are wondering why I would waste my energy on a chimera like time-travel."

I nodded. "Surely you are aware of the paradoxes. One can so easily produce a yes-and-no situation with a time-machine."

Ion smiled widely, mirthlessly. "Do you not understand your own work? This is just what you want."

We dropped the matter for then, and went on to discuss the bus routes, my apartment, the restaurants . . . the minutiae of life in a foreign country.

Ion insisted on taking me home with him for the midday meal. His house was only a few hundred meters from the Institute. His wife Klara greeted me like a long-lost cousin.

"Ion has been so looking forward to your visit, William. It is wonderful that you are here!" She had soft eyes and dark, sensual lips. A perfect wife, a perfect mother. How comfortable she made me feel!

I accepted a glass of kirsch before lunch. The clear, dry alcohol went straight to my head, but Ion assured me that Klara's after-dinner coffee would remedy that. Then the two children, twin ten-year-old girls, came crashing in.

The German school-day ends before one o'clock, and it is not unusual for the whole family to have their big meal together at midday.

"Do you fix such a big supper as well?" I asked Klara as we sat down to our cauliflower soup.

"This is not big," she said, looking down the loaded table. "This is nothing."

Besides the soup, there was a roast stuffed with hot sausage, a platter of fried potatoes, creamed spinach, cucumber salad, smoked cheese, two kinds of salami, dishes of pickled peppers, and a large carafe of excellent white wine.

"I have never seen such a magnificent meal in my life!" I exclaimed.

The twins giggled, and Ion laughed appreciatively. "You see, Klara? William is already learning the art of Hungarian exaggeration."

In the course of many happy hours spent at the Stepaneks' over the next three months, I was to become very familiar with this sort of conversation. A Hungarian is never happy without being ecstatic, never sad without being suicidal, never your friend without being ready to give you everything he owns, never displeased without being ready to kill. But there was, for all that, a consciously playful element to their exaggerations which somehow kept them from ever being oppressive.

Klara was thirty-five, about halfway in age between Ion and I. Before long I was thoroughly infatuated with her, and flirted shamelessly. Ion must have noticed, but perhaps he welcomed the excitement for Klara. Or perhaps he pitied me too much to object.

I got in the habit of dropping my spoon at most of our frequent common meals. Bent and straining under the table, I would stare at Klara's legs. She could feel my gaze, and would slowly rub her nylons against each other. When I sat up again she would give me a look

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of dreamy speculation, her full lips parted to show a few of her perfect teeth. I hoped my hopes and dreamed my dreams.

Meanwhile, Ion and I were working long hours on our joint project. His intention was to push the Feynman time-reversal theory of anti-matter hard enough to get time-travel. He had the clout to get the necessary components and materials—some of them totally new. My job was to assemble the components into a working system.

There is something magical about scientific apparatus. A witch-doctor assembles decorated stones, special herbs, pieces of rare animals . . . and he expects that putting these valued objects together will cause something unusual to happen. Spirit voices, levitation, miracle cures . . .

The constructions of engineers and physicists are not really so different. Bits of etched silicon, special chemicals, oddly shaped pieces of metal . . . the experimentalist places them together, and suddenly one has a radio, or an airplane, or an X-ray machine.

Stepanek's design for a time-machine was a bit more obviously allied to sorcery than is customary. The key components were six of the brand-new *phase mirrors*. It was only as a result of his years-long friendship with the director of the Max Planck Institute that Ion was able to get these fantastically rare and valuable plates of . . . what?

The phase-mirrors were made of a completely new type of substance called quarkonium, a hyper-stable compound something like metallic helium—but with some of the protons' component quarks replaced by the newly obtainable "bottom" quarks. Quarkonium is, strangely enough, neither matter nor anti-matter. The stuff exists in some fantastically charged tension between the two. The fact that quarkonium is thus hyper-stable made it possible that, in certain circumstances, the phase-mirrors could emit or absorb almost their entire mass-energy without disintegrating.

Two of the thin, inflexible quarkonium plates were square, and four were longish rectangles. I assembled the six into a box, setting an evacuation nozzle into the hole with which one plate had been provided. The material was strange to work with, slippery and utterly rigid. Although they were supposed to be a sort of mirror, the plates did not reflect images in any ordinary way . . . at least not most of the time. But, over and over, as I was assembling the phase-mirrors into a box, I seemed to glimpse isolated images of my finger-tips here and there on the mirrors' surfaces.

We spent forty-eight hours pumping the box out to a state of near-perfect vacuum, and then sealed it off. While the pump was running, Ion instructed me to mount a series of wire loops on the table, loops which could be charged to produce a weakly guiding magnetic field. We set the box in the middle of the loops, and that was about it. A transparent box like an aquarium with a glass top. Ion called the box a time-tunnel, but I found this colorful description misleading.

We ran our first tests with an electron beam. The idea was that a signal could come out of one end of the box before it went in the other. It's called an ad-

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vanced potential in quantum mechanics. We got the results Ion had predicted, so we moved up to atomic nuclei, and then to a series of larger and larger iron bullets.

Shooting the bullets into that phase-mirror box made me a little nervous. . . . I expected the box to shatter. But somehow it didn't. I assumed it was because the quarkonium plates were, in some sense, liquid, and thus able to pass and close up after a rapid enough object.

I believed that for a while, anyway. But before long I had come to believe something stranger . . . that the box was able to create and destroy matter/anti-matter pairs. But where was the energy coming from? And where did it go?

Ion had an explanation. But I was not ready to accept his description of what we had built. That way lay madness.

"Do you know what your husband and I have done?" I asked Klara at lunch the last day of February. The twins had already left the table to do their homework. I glanced at Ion, and he gave me an encouraging nod. Until now I had been sworn to silence.

Klara looked a bit nervous at my question. Ion was, I had learned, something of a philanderer. What a fool to betray a woman as wonderful as Klara!

"Nothing too depraved, I hope?" Her voice was gay, but with the faintest tremolo of real worry. She drew out a cigarette and placed it between her wonderful lips, waiting for the touch of my lighter . . . the lighter which I had bought solely so that I could light Klara's cigarettes. She tilted her head back, away from the smoke, and looked at Ion questioningly.

He smiled his broad, mirthless smile. "William and I have assembled a rather interesting piece of apparatus. It creates and destroys matter, according to William's way of looking at things."

Klara arched her eyebrows at me. "Is that true, William? Perhaps you have solved the energy crisis?"

I laughed, a bit exasperated by Ion's misdirection. "No, no. This is a very expensive machine to build. We have used most of the quarkonium in the world to build it. And really it creates and absorbs matter/anti-matter *pairs*, rather than just matter. But Ion thinks . . ."

Ion was pouring himself a glass of wine, and the carafe clattered against his glass. "I do not *think*, William, I *know*. We have built a time-machine." Suddenly, on some level, we were fighting over Klara.

She blew a thick stream of smoke and put out her cigarette. "I would like a time-machine. Then I could see what the castle looked like in 1400, before the French blew it up. And I'd like to see dinosaurs. And the fashions one thousand years from now." It was clear she didn't believe Ion. "Dearest, do you think you could bring me back a kitchen-robot from the future? It would be even nicer than that dishwasher you're always promising to get me!"

Ion was breathing heavily. He had had several glasses of kirsch before lunch. This quarrel had been brewing for three months. I thought his experiment interesting, but I saw no reason to take Feynman's theory so literally as to assert that we had produced time-travel. Ion could see this in my eyes.

He stood up suddenly, almost as if to attack me. Was he, on top of it all,

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jealous of my attentions to Klara? New Year's Eve, after he had passed out, Klara and I, how close we had come! I tried to keep this out of my eyes. I stood up clumsily, and my chair fell to the floor behind me.

"Don't panic, William," Ion said, shrugging on his suede jacket. "I only thought that we could give Klara a demonstration."

The twins, attracted by the noise of my chair, had come running in from the study, and insisted that they too be allowed to come see Daddy's machine. Ion acquiesced, on the condition that they bring a certain toy.

We all bundled into our coats . . . Klara wore a charming fox coat sewed in herring-bone strips . . . and we walked the three blocks to the Physics Institute.

The twins ran ahead of us, screaming and trying to slide on the frozen puddles. Klara walked between Ion and me, linking an arm with each of us. The sky was low and gray. The eternal mist seemed to form a circular wall around us, always ten meters off.

"Should we show Klara the bullet series?" I asked Ion, speaking across Klara's lovely, upturned face.

Ion pursed his lips and shook his head. "Too fast. Klara has to see it to believe it."

"Believe what?"

"We have a sort of tunnel," I explained. "The size of a toy train tunnel. And if we shoot a bullet through it, the bullet seems to come out the right end *before* it goes in the left."

Klara laughed. "Now *that* sounds useful. We could use one of your machines in the tunnel under the castle . . . where there's those dreadful traffic jams are."

"Actually," Ion said, "I thought I *would* use a little car today. The little three-wheeler that I helped the twins make last night."

The twins had brought the little car, a bright red-yellow-blue mass of Lego blocks. On the top was a battery-run motor, with a cogwheel linked by a black plastic chain to a gear on the single front wheel.

Klara examined our "time-tunnel" with interest. The core of it was the shoe-box-sized vacuum chamber made of phase-mirrors. You could see in quite easily. The thick loops of the guiding-field wires arched over the box like croquet wickets.

I removed the rifle from its mount on one end of the lab-table, and waited while Ion got the car from the little girls.

Then, bustling a bit, he lined up his three women in chairs against the wall, and set the car down at one end of the table. I cleared my throat, preparatory to telling them what they might expect, but Ion shushed me.

"First let them see, and *then* we'll discuss it."

I taped an iron nail to the bottom of the Lego car, and dialed the guiding-field's power up to some hundred times the level we had used before. The Lego car made a pretty big test-particle.

In all frankness, I expected the experiment to be a failure. The car would roll up to the phase-mirror box, bump into the side and stop . . . nothing more. But I was wrong.

As the little car labored across the table towards the left of the box, something happened at the right end. Seem-

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ingly out of no place, an identical Lego car pushed out of the right end of the tunnel and went chuffing on its way!

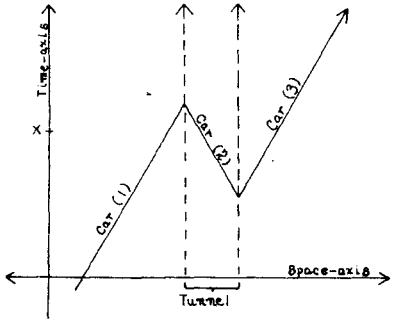
"And there's one inside now, rolling left!" Klara exclaimed, leaning forward. She was right. For a few seconds there were *three* Lego cars on the table.

Car (1): The original car, still approaching the tunnel's left entrance. Car (2): The one moving in the tunnel, from right to left. Car (3): The new one moving away from the right of the tunnel.

And then car (1) and car (2) met at the left-end mirror. They melted into each other . . . nose into nose, wheel into wheel, tail into tail. It was like watching a Rorschach ink-blot disappear into its central fold.

One of the twins squealed and ran to catch car (3) before it ran off the other end of the lab table. I took it from her and examined it closely. Car (3) appeared to be identical to car (1). We had already done this experiment with electrons and with small bullets . . . but one bullet or electron is much like another. Until now I had been unwilling to accept Ion's interpretation of our experiment. But it certainly looked as if car (3) really *was* car (1).

Ion stepped to the blackboard and drew this picture:



"Look," he said to Klara. "Here's a spacetime diagram of what happens. If we think of the zig-zag line as the history of a particular object, what we have is this: *First*, car (1) goes forward in time till it gets to the left phase-mirror. *Second*, inside the tunnel it flips and moves backwards in time, but still left-to-right, and we call it car (2). *Third*, upon passing through another phase-mirror it flips back to run forward in time again, and is called car (3). By evolving into car (3), the original car (1) manages to come out of the right end a few seconds earlier than it goes in the left."

"That's one way of looking at it," I interrupted. "But we can read the picture a bit differently. Just think of moving that space-axis upwards through time, and seeing what happens. First there's just car (1) moving to the right. Then suddenly something happens at the right end of the tunnel. Car (2) and car (3) come into existence together—by a process called *pair-production*. Car (3) is matter and car (2) is anti-matter. With enough energy present, you can convert zero Lego blocks into plus-forty-nine Lego blocks and minus-forty-nine Lego blocks. You can get something from nothing . . . as long as you get anti-something too."

My voice was baying evangelically. At Wankato State the students used to call me "Rover." Now Klara smiled at me. Politely. She didn't know what I was talking about. Ion hid a smile by pretending to rub his nose.

I continued. "When car (2) meets car (1), the two disappear into a burst of energy. It's called *mutual annihilation*. Matter plus anti-matter makes pure en-

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ergy. The first puzzling thing about the experiment is how the tunnel knows to produce the appropriate matter/anti-matter pair in time. But quantum mechanics does allow for action at a distance. *Advanced potentials*. Presumably an advanced potential from the approaching car (1) triggers the pair-production of . . ."

Klara looked quite blank by now. I broke off the exposition and made my point. "All three cars are different. Car (2) is anti-matter travelling forward in time, *not* car (1) travelling backwards in time. And car (3) is just a sort of correction term."

Klara looked from one of us to the other, smiling a bit. "Ion's right," she said finally, and with a nod of her head. "Anyone can see that the little car which came out is the same as the one that went in." She caught my dejected expression and laughed. "Well, what's the difference anyway? Whether the thing in the tunnel is a particle going backwards in time or an anti-particle going forward in time. It comes to . . ."

She had to break off and grab one of the twins, who had been about to try to stick her finger into a phase-mirror. A smell was filling the room, and we noticed that the other twin had opened one of the propane gas-valves set in the table.

"I better get these bad children out of here," Klara exclaimed. "But it's marvellous, Ion. And William, you must be very clever to have helped Ion build this!" A flash of lips, a swirl of fur, and she was gone.

I picked up the toy car and examined it closely. Even I had trouble believing my description of what had happened. How would the right end *know* to produce pairs in the right order to build up car and anti-car from nose to wheel to tail? And where would the energy have come from? Granted that a fantastic amount of energy was stored in the fantastically expensive quarkonium, but still . . .

Ion was sitting at his desk writing, his back to me. Despite what Klara had said, the two descriptions did *not* come to the same thing. Was this car the *same* as the original car, or was it only an *identical copy?* I had to know!

Suddenly I thought of a way to test the difference. I would let the car roll towards the tunnel, and at the last minute *I would* stop it from going in. A decisive experiment.

Suppose Ion was right. Suppose that car (3) was just a time-travelled car (1). What then? If car (1) did not go in the tunnel, then car (2) and car (3) would not come into existence.

But suppose I was right. Suppose that the whole effect was just advanced potential pair-production, triggered by car (1)'s approach. What then? Car (2) and car (3) would already have been created even if, at the very last second, car (1) did not actually enter the tunnel.

In terms of Ion's spacetime diagram, what I was going to do was to stop car (1) at the time marked "X." If car (3) came out anyway, then I was right. If car (3) didn't come out, then Ion was right.

I started the car and set it down. "Look, Ion." I didn't bother saying more . . . he would understand. I fixed my mind on grabbing the car at the last possible instant before it went through the . . . looking-glass. I leaned over

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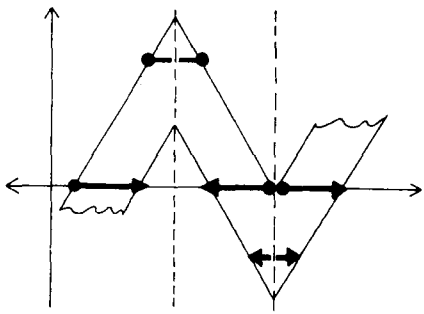
the table, concentrating. I didn't dare look away to see if car (3) came out the other end or not.

I seized car (1) just before its nose touched the phase-mirror. Then I stepped back and looked down the table. There was no car (3) at the other end . . . and no anti-matter car (2) at my end. Ion was right.

I returned the little car to the starting position and let it run through the time-tunnel undisturbed, trying to see it Ion's way.

A car moving *right to left* is the same as a car moving *left to right and backwards in time*. Suddenly I could see the pair-production and the mutual annihilation as *corners in time*. Ion was right, he really was. We had time-travel, admittedly over just a three-second range, but time-travel nonetheless. Even the strange fact that the phase-mirrors turned things backwards as well as reversing them in time made sense. The fact that the front of the car moved backwards in time as soon as it passed through the left end meant that a normal observer *had* to see it as disappearing first.



"Well?" Ion was smiling his wide, mirthless smile, his eyes picking my brain.

I nodded. "O.K. But how does the car get through the phase-mirrors? They felt so hard when I was gluing them together."

Ion shrugged. "How does a reflection get through an ordinary looking-glass? It is the property of a mirror to produce images. But this particular mirror works only when the guiding-field is on." He pointed to the left end of the time-tunnel.

Time-tunnel. As I said the word to myself, my last remaining question dissolved. If car (1) was car (2) was car (3), then no mass or anti-mass at all was really being created or destroyed. So of course there were no huge energy drains or blasts going on. Looked at differently, the quarkonium plates were a closed system which could pass energy back in time . . . so the pair-producing drew its energy from the annihilation, even though it happened first.

I nodded again, harder. "O.K. But now what?"

"Aren't you worried about time-paradoxes anymore?" Ion's voice was challenging, almost angry. It was as if he hadn't wanted me to agree with him . . . hadn't wanted it to be true. The next question: *What if one were to stop car (1) if and only if car (3) has already appeared?*

I didn't say it, but he could see it in my eyes. The fear. Suddenly fatherly, he patted me on the shoulder. "Take the rest of the afternoon off, William. I want to write all of this up before . . . before I continue."

I nodded and left him there. I spent the next few hours drinking Schlossquell beer, and then I went to the Eros House, a shabby building full of legal

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prostitutes. With the lights off, I could almost believe I was with Klara. Later I had more beer.

I slept badly that night. At four in the morning an unpleasant dream woke me up so completely that I couldn't go back to sleep. It was a scene inspired by Kafka's *The Castle*.

In the dream, through some transmutation, the Heidelberg castle is . . . *science*. Endless corridors, doors, people to meet. On the white plaster walls there are things like fire-alarms, little hammers mounted over glass plates. Behind the glasses is . . . *cyanide*, thick gas, swirling, deadly. I hurry down a hallway, a sheaf of papers in my hand. Someone is in front of me, tangible, but invisible. My other self? Somehow the person moves so as to always be in my blind spot. A question is posed, the unspeakable question which the castle itself embodies. My tongue is slow and sticky. Yes and no. A bell is tolling. Yes and no. The hammers quiver. . . .

The world is clouds and fog patches, a confused smear which no magical apparatus can sharpen up. The cat knows.

That morning I found Ion sitting at his desk. He was asleep, with his head on his crossed arms. One of the phase-mirrors was cracked! Had Ion had some sort of tantrum? I examined the hairline crack. Of course the vacuum was ruined now. I wondered if the quarkonium plate could be repaired. There were some individual Lego blocks scattered around the floor and table. Apparently Ion had been there all night.

I stood over him for a moment, looking at him with something like affection. I had been worried, too worried to even. . . .

"William?" The voice was blurred. His eyes flickered open, then shut. "Is it raining?"

This struck me as a very odd question. It was, in fact, a marvelously sunny day, the first taste of spring. The sky was a delicate blue and the birds were singing. A square of sunlight was lying on Ion's desk!

"It's sunny, Ion."

"I thought it was. And I thought it was raining." His voice was muffled, and seemed somehow to come from underneath his head.

"You should get some sleep," I urged. "Klara must be worried."

"I'm scared to move." A long pause. "I *might* disperse even more."

Disperse? A strange word to use. Wave-packets disperse, but people. . . .

"Read my notes," Ion said, "I. . ." He let his voice trail off, and just sat there, eyes closed, his head resting on his crossed arms. There seemed to be something under his arms, some sort of pillow.

I picked up the lab-book lying on his desk. It started with a description of the apparatus and the first experiments we had conducted. Nothing new there. I flipped forward a few pages.

There was a diagram like the one Ion had drawn for Klara. Under it was a sketch of the Lego car and a description of the two experiments, the one where the car comes out of the time-tunnel before it goes in, and my variation, where the car is stopped from going in, and therefore does not come out.

Ion had conducted a third experiment. The car was to roll towards the tunnel while he watched both ends. His plan was to stop car (1) if car (3) ap-

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peared, and to let car (1) go if car (3) did not appear. This meant that a car would come out of the right end of the tunnel if and only if no car came out of the right end of the tunnel. Yes if and only if no.

Think about it. Either car (3) appears or it doesn't. *Case I:*) Car (3) appears. So Ion stops car (1) from entering the tunnel. So car (3) doesn't appear. *Case II:*) Car (3) doesn't appear. So Ion lets car (1) into the tunnel. So car (3) appears.

Question: When Ion actually ran the experiment, did car (3) appear? *Answer:* Yes and no.

I closed the lab book and looked around the room. The scattered bits of Legos . . . how many?

"What happened, Ion? Did the car come out of the tunnel?"

"Yes," Ion said, raising his head from on top of his arms.

"No," Ion said, uncrossing his arms and raising up his other head from under the arms.

The two faces looked at me, each of them a bit translucent, a bit unreal. The two necks merged into his collar, making a solid, tubular letter "Y"

I gagged and stepped back.

The phone began to ring. The second of Ion's heads . . . the no-head . . . seemed not to hear it, and continued to stare at me with those prehensile eyes. Eyes which reached deep into my mind.

But at the same time, Ion's hand groped up the receiver and held it to the first head . . . the yes-head . . . to one of the shimmering ears. I could hear Klara's tiny voice. She sounded angry, accusing.

"I was working," the yes-head said.

"Your boyfriend is here," the no-head said, noticing the conversation. "I'm going to show him something."

Ion let the phone drop and walked over to the laboratory table. The no-head, the mean one, was doing the talking. Whichever head was talking tended to be bigger. It was as if the silent head corresponded to some part of Ion which was farther away . . . drifting towards some parallel universe.

"I'm in a mixed state, William. I ran the paradox. It had to come out both ways." He turned the switch to power-up the guiding-field. It was dangerous to be restarting it without a vacuum in the chamber.

The no-head bent down, peering into the cracked phase-mirror. He was still talking to me. "I know how you think I look. But that's just your projection. Actually it feels . . . marvellous. You'll see in. . . ."

"Get out, William," the yes-head cried. "Before it's too late."

Klara's voice was quacking from the dangling phone receiver. I could feel myself going mad, as surely as a cloth tearing. I seized the phone to speak to her. "This is William. Ion's had a terrible accident. He. . . ."

There was a crash behind me. I whirled around. The time-tunnel was billowing smoke and the phase mirrors had smashed into pieces. For a second I couldn't see Ion through the smoke, but then he came at me.

A tangle of twenty or a hundred thin necks writhed out of his open collar, and on the end of each tentacle-like neck rode a tiny grimacing head, and every little head was screaming at me in a

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terrible tiny voice. . . .

He dispersed completely after that. As different variants of Ion Stepanek split off into different universes, each corresponding head would shrink . . . get "farther away" . . . and a copy of his body would split off with it, twisting and dwindling. I don't know how long it took; I don't know how I could have seen it; I wish I could forget it. The horrible squid-bunch of necks, each little head screaming out something different . . . I hope he's really gone.

I live with Klara now, and I wear Ion's clothes. I have taken over his job at the Institute . . . they think he's resigned. Klara forged his signature on the letter.

It's a good life, except for having to cut the buds off my neck every morning. The wart-like little heads. Some look like me, and some look like him. Klara says I only imagine them, and that there's nothing on my neck but eczema.

I still have the specs for the time-tunnel. Maybe I'll rebuild it, and observe a yes-and-no, and disperse. I'll go into the mixed state and come out . . . who knows . . . maybe in heaven. But I don't really need the machine anymore.

Mixed states happen all the time. Say someone asks you whether or not you want to kill yourself. Before they asked, maybe you weren't really all that much for or against suicide. That's your original mixed state. But answering the question is like being born. You have to stick out a yes-head or a no-head to answer. And the other one has to get shaved off.

It could be any question. Do you like milk? Who are you going to vote for? Are you happy? Do you understand what I'm talking about?

In a way, mixed states are nice. Not naming things, and not forcing them to be this way or that, but just . . . letting go. *Satori*. There's a Zen question for it: "What was your original face before you were born?"

My original face. A mixed state. I don't need a machine, no heap of glass and wire. I'm just going to walk out on the bridge towards the castle. I'll stop. Out there, in the wind, one need not choose this bank or that. There are other alternatives. ■

● I find it difficult to understand a scientist who does not acknowledge the presence of a superior rationality behind the existence of the universe as it is to comprehend a theologian who would deny the advances of science. And there is certainly no scientific reason why God cannot retain the same position in our modern world that he held before we began probing his creation with telescope and cyclotron.

WERNHER VON BRAUN

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Jay Kay Klein's

BIOLOG

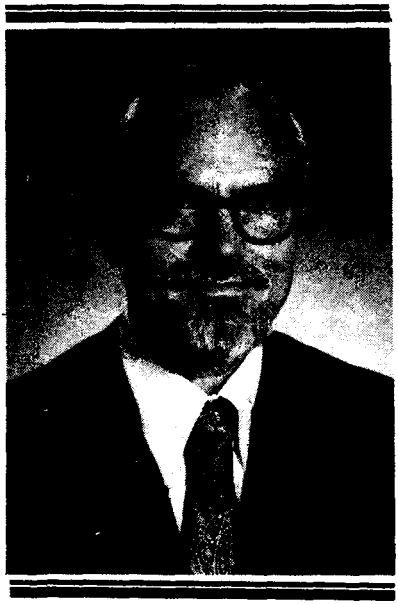
"The Author, justifiably mad, is a patent attorney," read editor John Campbell's introduction to the first Leonard Lockhard "Profession" story about the mad world of patent applications in the September 1952 issue. Behind the pen name was Charles L. Harness, who already had been a contributor for over four years, and a patent attorney with not only an LL.B. from George Washington University but also a B.S. in Chemistry from T.C.U.

Charles notes that his profession has strongly influenced his writing, not just in the Lockhard stories, but in the many others in which lawyers and patents figure strongly. He collaborated with Ted Thomas, another science-fiction-writing patent attorney and at the time a fellow employee at a large chemical company, on the second "Profession" story, and Ted did the remainder of the series. Today, Charles mostly does novels, with two new ones coming out from Pocket Books, *The Catalyst* and *Firebird*.

He was born in Colorado City, Texas, and raised in Fort Worth, where his first job in Depression days as a teenager paid $14 a week. Of some compensation to the drudgery of working in a paper warehouse was its location within a red light district, where Charles says he made many interesting friends. Later, he became a fingerprint clerk in the police department. The accompanying badge would get him into a movie house when flashed at the ticket taker.

Science fiction writing started shortly after college days, when Charles decided he could use the money to stretch the meager return from a beginning lawyer's income. The first story he ever wrote was a novelette that was immediately bought as a cover story by John Campbell, while not incidentally bringing the author what seemed like the stupendous sum of $175. He has continued to write, even though today he is a patent attorney in the Washington area for W. R. Grace & Co., a conglomerate that has large chemical holdings.

Typical in writing only science fiction, but atypical in never having attended a science fiction convention, Charles shares the affection for the field that is virtually a hallmark of those who write for it. He feels that science fiction has filled what otherwise would have been a gap in the lives of persons in a technological society. He says that science fiction itself has grown because of dedicated people. Charles Harness' 33 years in the field surely makes him one of these.



Charles L. Harness

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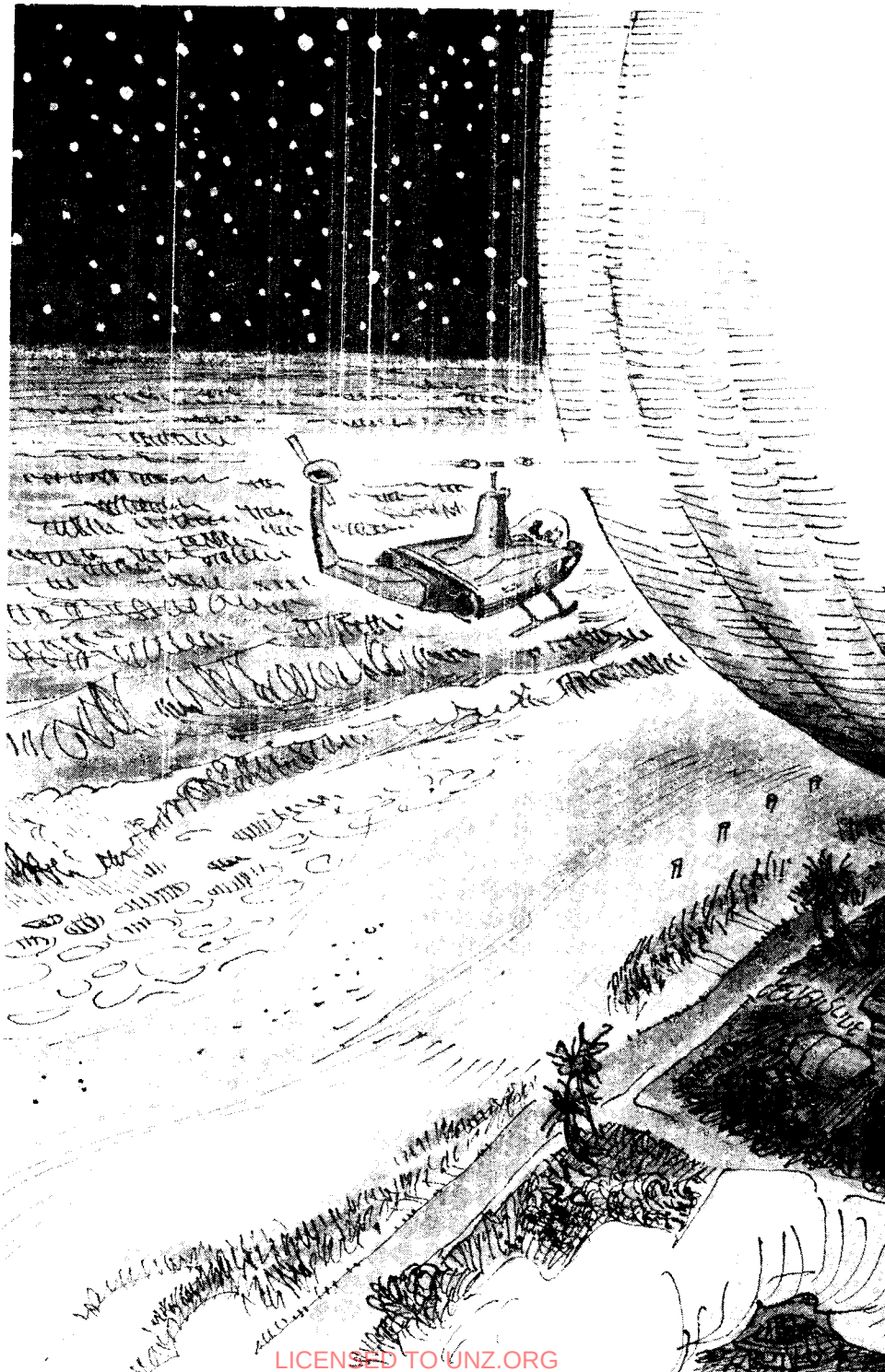

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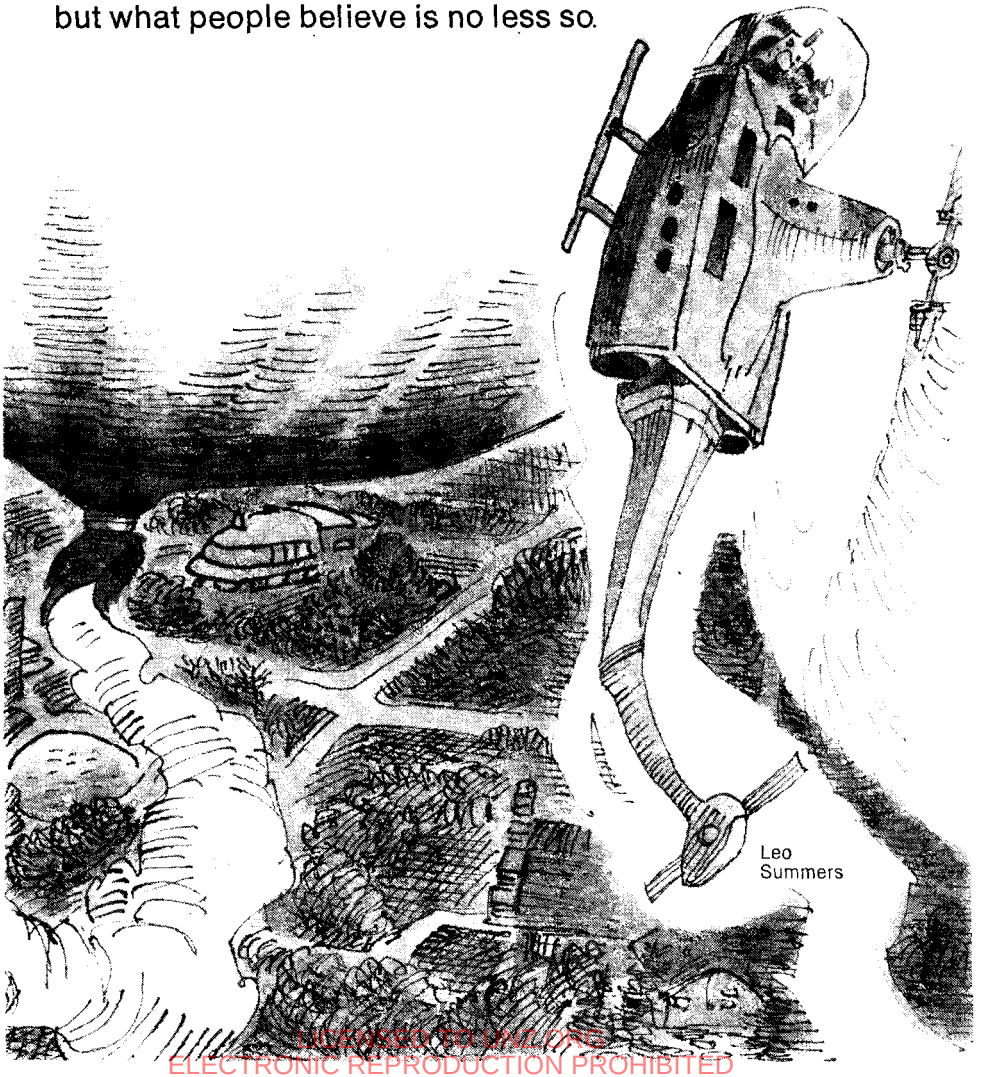
PAUL J. NAHIN

SECURITY BLANKET

What is true is important of course—
but what people believe is no less so.



Leo Summers

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The nuclear cruiser USS *Long Beach* was in the fifth day of her mission of beating the Barents Sea into a beer-like froth. Running at her cruising speed of eighteen knots at 40 degrees longitude East of Greenwich, and at a latitude about that of Smidovich, she towed the enormous paddle-wheel contraption behind her in an embarrassed silence. A silence broken only by the rhythmic slap-slap-slap of the thirty huge, ten-meter-wide blades.

The crew of the Soviet surveillance submarine tailing the *Long Beach* couldn't understand what the crazy Americans were up to. The Americans on the *Long Beach* didn't know either. They were just following orders. Told to tow the spinning monster, they towed it.

The Russians, using a narrow beam, anti-intercept satellite channel, transmitted their observations back to the Committee for State Security.

It was Bobby Wilson's mother who first noticed that her son was strangely quiet. It wasn't normal for any nine-year-old boy to just sit in a chair, staring out the window for twenty minutes without moving. Certainly it wasn't normal for Bobby Wilson.

He had just gotten home from school, and Mrs. Wilson wondered if he might not have picked up the flu bug from one of the other children. She knelt beside him and pressed a hand to his forehead. "What's the matter with you, Bobby? Here, let me feel your head for a fever."

Bobby didn't try to twist away like he usually did when his mother got worried about his health. He just mumbled, "Ah, Mom, I'm not sick. I'm just thinkin', that's all."

His mother stood-up and looked at him, her hands on her hips and a worried look on her face. "You sure? No stomach cramps, or sore throat, or maybe a headache?"

Bobby shook his head no, but said nothing. That *really* worried Mrs. Wilson—she liked to joke that the only way to shut her son up was with a big cork and a hammer. And then Bobby did something that shocked Mrs. Wilson, and made her turn away without another word. She decided right then and there that whatever was bothering Bobby was serious enough to discuss with her husband.

"He was *sucking his thumb*? Well, kids sometimes *do* that, honey, it's nothing to get all worked up over." Mr. Wilson was trying to read the evening paper before dinner, and still not get into trouble with his wife by obviously ignoring her. It was a hard act to pull, and twenty years of marriage hadn't dulled the challenge. This time, though, it didn't work.

"Tom, this is serious. Now *listen* to me! You know Bobby would would rather *hit* his thumb with a brick than get caught sucking it—not after all the teasing he got in school over it. He hasn't done it for over a year, and now he's back doing it. His behavior is regressive. He's obviously under some sort of stress, what with his moping about the house. He won't tell me a thing, but maybe you can find out what's troubling him."

Tom Wilson could see it was no use. Putting his paper down with a sigh, he replied "All right, Mary, where is he?

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In his room?''

''Yes, he's been up there all afternoon. Why, when Peter White, Bobby's very *best* friend, came by a couple of hours ago to ask him to go frog-catching over at Jackson's Pond, Bobby said *no*. That *proves* something is wrong, Tom!''

In spite of himself Mr. Wilson couldn't keep from grinning. ''Begged off on frog-catching, huh. By George, Mary, that's proof enough for me. That's *definitely* not *my* boy! I'll go have a little talk with him.''

Tom Wilson put his paper aside and went upstairs to his son's room. The door was open, and he could see Bobby sitting at his desk. His room was in a general state of chaos, but that didn't concern his father. Mr. Wilson's lack of neatness caused his wife nearly as much despair as did her son's.

''Got a minute to talk, son? Your mother is sorta worried about you, and I thought maybe we could talk it over together.''

Mr. Wilson could see his wife had been right. Bobby *did* look unnaturally serious.

''Sure, Dad. I'm sorry if I got Mom upset. But I'm not sick. I've just been thinking, that's all.''

''That's good, Bobby, but whatever you're thinking about must be pretty serious to keep you from frog-catching! Wanna tell me about it?''

''Yeah, I guess I *was* kinda rude to Petey. But I'll go to the pond with him tomorrow. I promise. I just didn't feel like it today.''

Mr. Wilson carefully picked his way through the model airplane parts and the stray clothing on the floor and sat down on Bobby's bed. ''Okay, sport, shoot. What's on your mind?''

Bobby swung his chair around to face his father, and looked him straight in the eyes. ''Dad, could the *whole world* blow up? Could *everybody* be killed?''

Now *that* startled Mr. Wilson, but he could see Bobby was very serious. ''What makes you ask that, son? That's a pretty heavy question for a champion frog-catcher!''

''It was in science class today, Dad. Mr. Harris was talkin' about energy and stuff, and how the world is runnin' out of oil. And he talked about atomic energy and how all the countries in the world are buildin' bombs and other horrible things, and how they were so powerful they could kill *everybody!* Is that true, Dad?''

Mr. Wilson thought carefully before answering. *Boy, the world sure has changed since my father was a kid. What a damn shame children have to grow up worrying about such nightmares.*

''Well, yes, son, Mr. Harris *is* right. Atomic energy *does* have the capability to do harm. But *only* if people aren't wise enough to use it carefully. It's just like fire, Bobby. Fire is a wonderful thing, *if* you use it wisely. It warms us in the winter, and it can cook our food, and it can do a lot of other amazing things, too. Like make steel for cars, and ships, and buildings.

''It can also burn things, and people, too. It must be used wisely. It's the same with atomic energy. It can be used for good and bad, but it's *people* that decide that. *Atomic energy*, itself, is neither good nor bad.''

''Yeah, that's what Mr. Harris said, too. But he also said that atomic bombs

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are so big that even just one could kill maybe *millions* of people. And that if we had an atomic war that the whole Earth could be destroyed! Is that right, Dad?"

"Yes, it is. But you should also realize, Bobby, that such a war isn't very likely. Atomic weapons have been around a *long* time, and except for just two times, they've never been used. And even then there was a warning given, and we were already at war."

Bobby looked unconvinced. "I was thinking, Dad, since what Mr. Harris said, about how everything would be smashed if there was a war like that. You and Mom, and Petey, and the frogs at the pond—and me—we'd all be dead! I'm afraid, Dad!"

Mr. Wilson could see tears in his son's eyes, and it made him bitter. Why *should* a little boy have to have such a bloody sword of doom hanging over his head? Why couldn't kids enjoy their first years like kids used to, believing they were immortal? *Nowadays a kid gets to be old enough to understand words and he's immediately overwhelmed by the possibility of his own death!*

It was that last thought that made Mr. Wilson tell his little white lie. He ordinarily believed in being totally honest with his son, and Mary agreed with that—"if he's old enough to ask, he's old enough to be told."

But this wasn't about the birds and the bees—the poor kid was worrying himself sick about dying when he shouldn't be concerned about anything more complex than catching a frog. When Bobby got older, and was more mature, that would be the right time for him to worry about the difficult world he lived in. But not now; it was too soon!

"Bobby, I'm going to tell you something, but I want you to promise you'll keep it secret. Just between you and me. Okay?"

Bobby wiped his eyes with a casual swipe of a sleeve (he didn't want his father to know he'd been about to cry) and said "Sure, Dad. I'm real good at keepin' secrets."

"I know you are, son. Well, you know I'm not a scientist, but I *do* work at the government lab in town. So I hear things about what the scientists there are doing." He leaned forward and dropped his voice to a conspiratorial whisper. "Well, I hear there's a new electronic gadget the government has developed that can protect against atomic bombs. It makes a sort of invisible bubble over a city that you can see through, walk through, even fly through. But it stops atomic bombs. How it works is a big secret, of course, and I don't know anything about that, but even the fact it *exists* is a secret, too. So you shouldn't talk about it.

"Anyway, don't you worry about any atomic war!"

Bobby looked relieved. "You mean—maybe one of those bubbles might be over *us*, right now?"

"I can't say *for sure*, Bobby, but like I said, from what I hear, it seems like maybe that's the case."

Later that same evening, after their son was sound asleep, Mrs. Wilson asked what had happened to bring Bobby back to his normal, cheerful self. Mr. Wilson told her of the fib, and while she at first worried over the cor-

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rectness of telling such a tale, she soon agreed the result had been good. "After all, dear," Mr. Wilson had said, "*everybody* needs a security blanket of one sort or another."

Three thousand miles to the west, at about the same time the Wilsons were discussing the right and wrong of lying to children, two USAF helicopter pilots started on their regular late-afternoon mission of pushing a helium balloon over the California countryside. Flying at five hundred feet, and tipping their huge machines backwards at a dangerous angle, the blade-wash shoved the enormous, eighty-meter-in-diameter, silver-glazed sphere along at about five knots.

The flight plan was different each day, and on this particular one they were to push the balloon back and forth along a line joining the Marine Naval Air Station at El Toro, and March AFB in Riverside. They kept it up for several hours, thus insuring that the Soviet high-resolution, spy-in-the-sky photo satellite orbiting overhead would get a large number of superb pictures.

The local citizens had a wonderful time trying to figure out what the Air Force was up to. They had no more success than did the KGB photo-interpreters in the basement of Moscow's infamous Lubyanka Building at 2 Dzerzhinsky Square, who also puzzled over what the crazy Americans were doing. In the end, the new, incomprehensible data went into a computer file, along with the Soviet sub's earlier transmissions describing the strange antics of the USS *Long Beach*.

Three weeks later Tom Wilson received an unexpected noon-time visitor. Sitting in his cubicle work-area with neck-high glass paneling on top of the movable wall-sections, he was engrossed in that week's PERT charts for the project he was monitoring. Things were going well enough overall, but these latest computer printouts had red-flagged three potential bottleneck sub-tasks. Any one of them could delay the projected completion date of the project.

As he began to mentally compose an inter-office warning memo to the section chief in charge of those sub-tasks, he became aware of the small, well-dressed man standing in the doorway.

"Yes, may I help you?"

The man remained motionless, but smiled back. "Are you Mr. Tom Wilson? I was directed here by the receptionist in the main lobby."

Tom stood and, after observing that the man wore the purple badge that meant he needed no security escort, held out his hand. "Yes, I'm Wilson. What can I do for you?"

The stranger stepped forward and the two men shook hands. "Mr. Wilson, I'm Special Agent Frank Agnew. I work out of the Boston FBI office. I wonder if I could have a few minutes of your time to discuss a matter that has recently been brought to our attention." The agent reached into an inner coat pocket and flipped open a small leather wallet that displayed a shiny metal ID.

Tom was used to government visitors, and while he'd never talked to an FBI agent before, it didn't bother him to have one show up unannounced. Biosystems Lab was a government-funded outfit and he knew the FBI han-

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dled the occasional cases when classified documents got misplaced. Tom figured some poor, unlucky soul had misplaced a secret folder. It was unpleasant, but it happened.

Waving to a chair, Tom said, "Sure, have a seat. I need a break from these damn PERT charts anyway! Ordinarily I don't work through lunch, but we've got some schedule deadlines coming up and I want to be sure we don't slip."

The agent smiled again. "I won't take long, Mr. Wilson. There's nobody else around right now, so we can talk right here." He sat down and took out a pen and notepad.

"Tell me, Mr. Wilson, just exactly what *is* your function here at Biosystems?"

Tom pointed at the piles of computer paper on his desk. "This is it. I'm an accountant by training, with on-the-job experience in computer data processing. I manage the weekly progress of all the little jobs—we call 'em sub-tasks—that together make up a whole project. Then, by knowing how they all fit together—you know, which ones require which others to be finished before they can start, and so on—I can forecast our final completion date. Or maybe I should say the *computer* can forecast the date. And even more important, it can identify those sub-tasks which are becoming critical. That means that if *they* fall behind schedule, then the *whole* project slips, too.

"We watch those sub-tasks *very* carefully. That is, the PERT computer program—that's 'Program Evaluation and Review Technique'—monitors things for us."

The FBI agent had made some quick notes as Tom spoke, but they were about *him*, not what he did. Tom would have been surprised if he could have read them. 'Wilson is intelligent, articulate, open in discussing his work, very co-operative.' He paused for a few seconds while he formed his next question and Tom mistook that for a problem.

"Say, what's this all about, anyway; have I done something wrong?"

"Certainly not, Mr. Wilson," replied Agnew, "at least, nothing we know about." The agent grinned as he said that, and Tom felt better.

"Look, Mr. Wilson, let me be completely frank with you. I've checked your security file, talked to your supervisor here at Biosystems, and there is absolutely no question about *you*. But there *is* a problem. As you've just said, you are *not* a scientist. You've had no formal training in physics, advanced math, or electronic systems. An intelligent, well-informed person, yes, but lacking knowledge in certain specific areas of hard technology.

"So how do you explain the fact that your son is telling his school friends about a radiation-and-blast-activated force-shield? And saying that his *dad*, who works at the government lab, told him all about it?"

Tom Wilson sat stunned and open-mouthed. Then he slowly began to turn red with embarrassment. "Oh, my gosh, Bobby must be talking about my little story! I guess I should've known a boy his age couldn't keep *that* a secret."

" 'Little story', Mr. Wilson? Tell *me* about it, will you?" said the agent.

Tom quickly filled the FBI man in on Bobby's fear, and how he'd handled

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the situation. The man listened quietly and made some more notes.

"Well, I can understand how a father faced with a situation like that might make up such a tale. Of course, you *did* make it up, didn't you? Or *did* you hear someone here at Biosystems speak of such a force-shield?"

Tom laughed. "Of *course* I made it up. There's no such thing as a force-shield!" Then he peered closely at his visitor. "It *is* impossible, isn't it?"

It was the agent's turn to laugh. "Well, I'm no scientist, either, Mr. Wilson, but naturally, if there *was* such a thing, it would be a clear security violation to talk of it. Wouldn't it?"

Of course Mr. Wilson agreed, and the agent soon departed. But Mr. Wilson thought about the curious visit for a long time after that.

The three cars carrying the visiting Soviet scientific delegation sped along the nearly empty road. The scientists had been pleasantly surprised at the ease with which they had received State Department approval to travel to the Montana conference on energy conservation. Two bored KGB agents posing as delegates sat in the car bringing up the rear as the hot, lazy desert miles pounded by.

Then they encountered the detour signs and had to change their route. Soon after that they and the rest of the traffic in both directions were stopped by military police as several heavy earthmovers belonging to the Army Corps of Engineers rumbled across the asphalt. The KGB men could see, about two hundred meters off to the left, down in a gully, a large group of enlisted men working in the ground. Observing that they were being ignored by the police, the agents took some photos with their concealed minicameras. Things *were* boring, and it would show their superiors back home that they were ever vigilant. Anyway, it wasn't smart to return from abroad with unshot film.

Three weeks later, after blowing up the fine-grained film, the Moscow photo-interpreters were puzzled once more by what they saw. Nearly one hundred men were digging a trench precisely thirty centimeters wide and, from shadow measurements and the quantity of excavated dirt visible, at least ten meters deep. Fourteen hundred meters in length and straight as a laser beam, it was far too narrow for missiles, and too deep for men.

In frustration the Lubyanka people finally consulted with their counterparts in the GRU, located in the new building for the First Chief Directorate just outside Moscow. Military Intelligence/GRU is a division of the Soviet General Staff, and while under the thumb of the KGB, it is operated mostly by knowledgeable military men, and not the political hacks, goons, and bumblers of the KGB itself. But even they were stumped by the photos.

After much debate that led nowhere, the data went into the computer file, along with all the other nutty American activities. By now the Russians were getting new, crazy reports almost daily. They all went into what had become known as "the lunacy file."

A few days later, deep in the bowels of the Pentagon, a clerk/typist with an unusually high security clearance pre-

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pared a memo. To be hand-carried by an Air Force colonel to each of the twenty-one men and two women named on its distribution list, it could be read only in the colonel's presence and no note-taking would be allowed. After all had read the document, the colonel was personally responsible for destroying it.

After typing the memo, the clerk removed the typewriter ribbon and placed it in a special, unmarked canvas burn-bag. Two hours later the bag flashed into vapor as it was dropped into a plasma-jet incinerator.

Classification: MOST SECRET/EYES ONLY
To: Project BUBBLE
Oversight Committee
Subject: Resolution of apparent security violation
From: Office of the Joint Chiefs of Staff
(General W. K. Allison)

> The initial fears that Project BUBBLE has been compromised have been shown to be incorrect. The reports of a security leak at Biosystems Laboratory were based on an occurrence which has been fully and satisfactorily explained by the report of one of our sister organization's field agents.
>
> Indeed, the nature of this occurrence is such that it has been determined to be a higher quality misinformation operation than was originally planned. This fortuitous occurrence has moved the timetable up on this part of the Project by several weeks, but it has been determined that this is acceptable.
>
> All previous misinformation operations have proceeded without mishap, and additional operations are being implemented on schedule, as are BLUE FLICKER, FLAME WHEEL, and KILLER BIRD. Operations SEA BEATER and BALL BLOWER are scheduled for de-deployment on schedule. Operation RAZOR TRENCH will be allowed to continue for one additional month, to compensate for the early release of the operation discussed above, as well as to provide our friends with additional satellite photo opportunities.
>
> All research activities for Project BUBBLE are on schedule. Four days ago the test bubble at the Nevada site successfully contained a ten-megaton explosion with zero leakage, and thus would have protected its interior against a similiar weapon applied to its outer surface. This total containment of all thermal, acoustic, gamma, and neutron radiation was achieved with a twenty-seven percent safety factor in the field-stress overload tensor.
>
> Assuming Presidential approval, the first operational bubble will be installed over Washington DC next month. The cities of New York, Boston, Los Angeles, and St. Louis will also be provided with bubbles within the following six weeks.
>
> Each of these operational bubbles will be powered by two enhanced statopulse field-mode generators, thirty percent more

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powerful than the device used in the Nevada test. This should provide a bubble radius of approximately 17 Km.

_____

_____

_____

Twenty-five miles to the southwest of Moscow, high on a bluff overlooking the Moskva River, sits the peaceful, artificial village of Zhukovka. It is the home of the Satellite Services Department of the First Chief Directorate of Soviet Intelligence in the KGB. Major Nikolas Gorki, however, had no time to enjoy the natural beauty of the dacha's surroundings. As he carefully settled his enormous bulk of almost three hundred pounds into a reinforced chair, Gorki pondered his urgent assignment.

A rarity in the KGB, he combined a superior intellect with a ruthless nature. Many of his colleagues had one or the other of these qualities, but few had both. He was a problem solver, and he wasn't used to losing. This new puzzle would be no exception. He had complete folders on every entry currently stored in the lunacy file, and a set of photographs of unmatched technical merit for almost all of them. Besides, he had another reason for pursuing victory.

While he knew from bugged embassy recordings that his American counterparts were well aware of his considerable talents, they were also fond of referring to him as "old Porki Gorki." Discovering the secret of this American game would be his revenge for such

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gross disrespect!

The satellite photos showed beyond doubt that there was no obvious fraud involved. The Americans really *did* have a nuclear cruiser towing that ridiculous hunk of junk, and they really *did* have military helicopters performing dangerous, if incomprehensible, manuevers. But what could it all mean? Well, his superiors might be confused, but Major Gorki wasn't. These crazy stunts were obviously all part of an enormous deception!

The Americans were up to *something* and hoped to mask it with a cloud of distractions. Who notices the green pear in the basket of green apples? Major Gorki smiled with quiet admiration for the shrewdness of the concept. It was a very clever form of security blanket. But he still had his basic problem.

Where was the *real* threat, hidden among all these carefully provided false targets?

Could it possibly be this long, impossibly thin, deep hole in the ground? Major Gorki carefully examined the photos of the trench with a magnifying glass, while he slowly smoked a fat Turkish cigarette. It tasted sharp, bitter, and the acrid smoke stung his eyes. It was a challenge to smoke such a terrible cigarette, but it was from the challenge that came the pleasure.

He pushed the trench folder aside after a while with a long sigh. Who could tell?—*maybe* it was a legitimate latrine, but such a hole would take the relatively few US Army troops in Montana twenty years to fill. And it *was* a bit too close to a public highway for that particular use. He took a new folder from the pile, while making a mental note to return to the hole later.

The major began to laugh after about thirty seconds of reading. A force-field bubble, impervious to ICBM hydrogen bomb explosions? A tale overheard by some agent, no doubt drunk, while lurking in the shadows at a children's school? What utter rubbish! The Americans had slipped on this one—it was just *too* silly. More likely still, it wasn't even a plant, but rather the result of a child's wild imagination. Oh, it was difficult to fool a man who had dedicated his life to mastering the art of deception as an instrument of national policy!

Tossing the folder aside with a disgusted grunt, Major Gorki gave serious thought to recommending burning the entire lunacy file. But that would be admitting defeat. The answer was in here someplace. He opened the trench folder again, and peered harder than before at the mysterious hole in the ground. Could it possibly be for the acceleration tube of an anti-ballistic missile, or particle beam weapon? Yes—*that* might make some sense. Porki Gorki reached again for his magnifying glass.

He'd find the answer!

● Science and religion, religion and science, put it as I may, they are two sides of the same glass, through which we see darkly until these two, focusing together, reveal the truth.

PEARL S. BUCK

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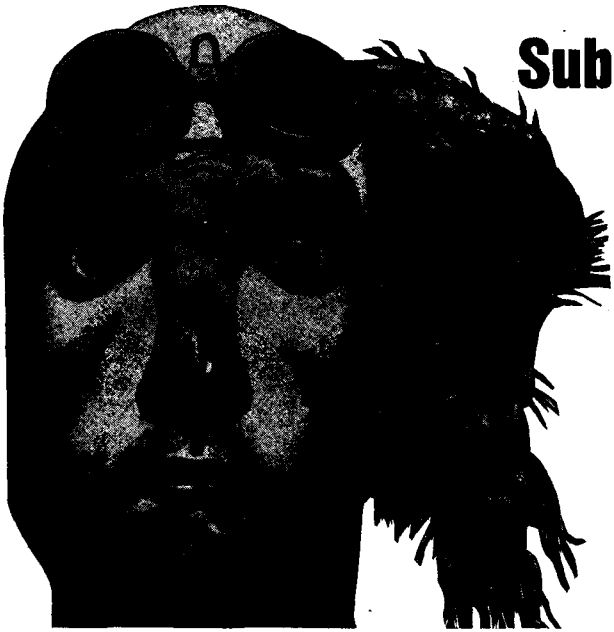

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Charles L. Harness

THE VENETIAN COURT

Patent law had changed—drastically—
and an invention which invents would obviously
complicate the application of *any* patent law.
But this case was *far* more
complicated than even that would suggest!

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"My dear Brother Speyer:

"It has come to my attention that proceedings in *United States v. Systems Motors* have been completed for over two years, but I have not seen your opinion. I wonder how this is coming? I appreciate that you have a crowded docket, but so have we all. We have some interns—third-year students from the University of Maryland—if you need further clerical assistance.

"As you know, *U.S. v. Systems Motors* is an extremely important case, not only for the case law that is sure to come from it, but also in casting a light on the economic future of a considerable segment of industry. . . ."

There was more.

Judge Speyer wadded up the memo and tossed it into the macerator. And then he scowled. *Systems Motors*. He would get to it. Why was the chief so antsy? He would get to it. Soon. He just needed something to charge up his psychic batteries. *Then* he could write that damn antitrust opinion.

He needed a death penalty case.

He got out his court calendar and pondered the entries one by one.

The criminal docket offered the usual array: computer embezzlements, extortions, armed robbery, dope, rape, even a murder I. But none carried the death penalty. He needed a trial where he could lay the big one on the defendant. Nothing. How was he going to get energized?

He put the criminal docket aside.

How about the civil side? Ridiculous even to think about it. What excitement was there in product liability, class action, breach of contract, negligence, employment discrimination?

And then his eye fell on the simple one-line entry, *Universal Patents v. Welles Engineering Corp.*, patent infringement.

This was it.

His heart began to pound.

He could do it. He could wrap this one up within two trial days. Start Friday. Let the poor doomed defendant anguish through the weekend. Wind it up Monday. Start dictating that damn antitrust opinion Monday afternoon.

"Why *me*?" said Quentin Thomas. He studied his visitor thoughtfully. She was pale, thin to the point of emaciation. Sunken eyes accentuated her high cheekbones. He detected faint traces of makeup—almost as though she had applied powder, rouge, and lipstick, appraised the result as hopeless, and had taken it off again. She wore a dark gray business suit, with matching light gray blouse and black tie.

"Why me?" repeated the lawyer softly.

Ellen Welles twisted her handkerchief in her hands. "My corporation counsel wouldn't take it because it's a patent case and will require highly specialized handling."

"And there are six major law firms here in Port City that handle patent cases. So still I ask, why me?"

"We went to them. They turned us down. But each of them recommended you, Mr. Thomas. You seem to have—" she searched for words "—a certain . . . reputation."

Quentin Thomas almost smiled. "You brought the complaint?"

She pulled it from her attaché case.

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As she handed it over she looked about the room. "Is this your office?"

"It's an anteroom to my apartment. I work here, and I live here."

"Just you? No partners? No associates?"

"Just me. When I need research, I call on the legal services. When I want papers typed, I just dictate them to the public steno in the mezzanine. But let's see what we have here." He studied the document briefly. "Universal Patents, Plaintiff, versus Welles Engineering Corp. and Ellen Welles, Defendants. Standard allegations of ownership of the patent for 'Electrically Conductive Polymer'. Infringement by defendants by making and selling their 'Fiber K', thereby infringing plaintiff's patent . . ." He looked over at her. "*Do* you infringe?"

"Yes. We're literally within the claims of the patent."

"And the patent is valid, so far as you know?"

"So far as we know. All the best references were cited. And it does appear to be an unobvious invention. It seems to meet all the criteria for patentability."

"Can't you simply stop making—what do you call it—Fiber K?"

"It's our main product. The whole corporation is based on Fiber K. We researched it several years ago, got into business, started selling, and filed our own patent applications. Then Universal Patents issued *their* patent. They were ahead of us. We couldn't believe it at first. They hadn't even done any research. Just a paper patent, cranked out by a computer. A computer-inventor."

"Faust," murmured Quentin Thomas.

"What?"

"Faust. That's the name of the computer. A man named Robert Morrissey invented it. He's in a looney bin somewhere today, but his machine keeps churning out the inventions. Universal Patents administers his estate. Interesting. Hmm." He thought a moment, running through the possibilities. Nothing seemed to emerge. It was hopeless. She was counting on him as some sort of last resort, but he just couldn't do it. "I'm sorry, Mrs. Welles. I can't help you. I can't take the case."

But she was not to be put off. "Is the greatest defense lawyer this side of the Mississippi afraid of losing a simple patent infringement suit?"

"Mrs. Welles—" He toyed glumly with the pen set on his desk and his voice became carefully noncommittal. "Some sad things have happened in the patent laws in recent years. Let me give you a bit of history. In the period 1985–2000, the United States Supreme Court broke every patent that came before it. In effect, the high court abolished the patent system. There was a strong legislative reaction. In 2002 the Congress enacted new patent statutes, completely removing most of the grounds previously used by the Supreme Court to invalidate a patent. The new patent statute may eventually turn out to be unconstitutional, but until the Supreme Court strikes it down, it's the law of the land."

"I'm aware of all that," said Ellen Welles.

He leaned forward and studied the pale features. "And did you know that the statute of 2002 makes patent in-

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fringement a criminal offense?"

Her sunken eyes glittered back at him. "Yes. Patent infringement is now a capital offense. It carries the death penalty."

The lawyer rose nervously from his chair and began to pace back and forth in front of the woman. Then he turned and faced her. "Mrs. Welles, something is missing here. I'm not getting through to you. If your company loses this suit, someone will die. Your answer to the formal complaint of infringement has to name that person. Otherwise you lose the case by summary judgment, and the court is entitled to designate arbitrarily any person within the management echelons. For example, the president or the chairman of the board."

Mrs. Welles smiled a twisted smile. "I know that, Mr. Thomas. As both president and chairman of the board, I will designate myself."

His eyes rolled up. "Oh God," he muttered.

She said, "There'll be a jury."

"The judge could take the case away from the jury. He could give a directed verdict." He thought about that. "Who is the judge?"

"Speyer."

Quentin Thomas started slightly.

"You've heard of him, of course?" said Ellen Welles.

"He's known in the circuit as 'Speyer the Spider'," said the man quietly.

"I know. I checked. I hear he's a borderline psychopath."

"You heard right. He's had two patent infringement suits under the new statute. He took the decisions away from the jury in both cases. He gave the death penalty in both. There's no appeal, you know. You must settle, Mrs. Welles. You have no choice."

"We've considered settling. But they want a royalty of fifty percent on the net invoice price of Fiber K. We would lose money on every pound we sold. We'd be bankrupt in three months. No choice, you say? That part is right. We don't have a choice. We have to fight."

"Perhaps you could buy the patent?"

"We tried. Kull and Ordway of Universal Patents told me they would never release Fiber K during their lifetimes."

"I see." He was thoughtful. "And you plan to name yourself as the sacrificial victim—the oblate, as they call it."

"Yes."

He showed his discomfort. "That is not at all necessary, Mrs. Welles. You have a daughter . . . twelve . . . thirteen? No reason you should take this risk personally. You can contract with a terminally-ill person—someone who has only a few months to live. The laws permit the designation of any willing oblate."

"*I* am terminally ill," she said gravely. "I am the proper oblate. This is my show, all the way."

God, he thought. She's here discussing this forcibly and logically, and she's dying. "I am sorry," he said. "I did not know."

"Lorie's thirteen. I'm trying to leave her something. To live on. For college. If you take the case, you're doing it for her. If you refuse me, I will have to handle it myself, on a *pro se* basis. And I've never been inside a law school, Mr. Thomas."

She waited.

He was thinking again. There was

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that patent case on appeal to the Supreme Court—*Universal Patents v. Williams*. The defendant, having been awarded the death penalty under the new statute, claimed the statute was unconstitutional because the statute denied appeal. The high court was expected to grant certiorari, but the question was when. Could he persuade Speyer to order a continuance until the Supreme Court ruled in *Williams*? If not, what other possibilities might he hope for? He knew the United States Patent Office had now reversed itself on the validity of the Fiber K patent. He could probably get the Commissioner of Patents on the stand to testify that the patent was invalid. And then there was Jethro Kull, the owner of Universal Patents, the giant holding company that owned the patent. He could subpoena Kull and torture him a little on the witness stand.

And with all this, what did he really have?

Nothing.

Well, he could take comfort in one thing: defendant's case couldn't possibly get any worse, but plaintiff's might indeed develop weaknesses as the trial progressed. It was like any other struggle involving great enterprises. Fate intervenes and odd things happen.

The proposition was beginning to interest him.

She was watching him intently. "Are you going to take the case, Mr. Thomas?"

He held up a hand. "Just a moment, please." He spoke into the communicator on his desk top. "Code 9."

The response was immediate. "Yes, Mr. Thomas?"

"I'd like the net worth of Welles Engineering Corporation."

"I can give you the public figures, taken from their latest annual report. The charge will be one hundred dollars."

"Can you get something more recent?"

"I can give you confidential data based on the first five months, certain, plus an estimate for June."

"How much?"

"The information will cost you fifty thousand dollars."

"I accept."

"The net worth as of June 30 was three million, one hundred thousand dollars, plus or minus ten thousand."

He looked at the woman quizzically. She shrugged.

The invisible intercom voice said, "Is that all, Mr. Thomas?"

"Who owns the stock?"

"For five thousand?"

"All right."

"There are three thousand shares outstanding. Two thousand are held by Mrs. Ellen Welles, a widow, and the remainder by her daughter, Lorie Welles."

"Thank you, Code 9." He punched out.

Ellen Welles said dryly, "I see my internal security could stand an overhaul."

"Don't feel badly. They put things together by computer, mostly from public sources."

"And occasionally by simple bribery?"

"Yes."

"So, what's the bottom line, Mr. Thomas?"

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"My fee would be high."

"How much?"

"If I win, one-third of the outstanding stock in Welles Corporation."

"If you lose?"

"Nothing."

"Who pays running expenses and incidentals?"

"I pay mine, you pay yours."

"It's a deal," said Ellen Welles. She stood up. "My lawyers will draw up the contract. You'll have it in the morning."

And so, thought Quentin Thomas, let lunacy begin.

It was midnight. He lay on his back in the semidarkness of his bedroom thinking about Ellen Welles and Fiber K and all the while staring at the sleep maze projected on his ceiling. For ten minutes his eyes had flickered along the borders, trying one alley after another. No luck.

He looked at the legend at the bottom, as though it contained a clue. But all it said was, Copyright, 2015, Sleep Enterprises, Inc. And below that, "A Sure Cure for Insomnia."

He shouldn't have taken the case. That woman would die, and it would be his fault. He twisted his shoulders. Of course, she would die anyway. But this way it was more nearly certain, and faster. By this time next Monday she would be dead.

Flicker . . . flicker . . . no solution. It was the first maze he had ever missed. That thing with Judge Speyer. That bastard. The hanging judge. And now he had him again.

Ah . . . no . . . false lead.

Twice around the border now.

A legend at the top of the maze began to flash: "Ten minutes. Is this too difficult for you? Do you want the solution?"

"Go to hell," he growled.

There was a brief interval; then the whole maze began to flicker. On and off, on and off. A pattern. It's gone crazy, he thought. Probably inoperative. No solution. He watched it for a moment. Flicker, flicker, on and off.

He flipped off the projector and lay there in the dark, staring at nothing. Perhaps into time. The seconds were ticking. Should he count the seconds? How many seconds until Ellen Welles' murder? Trial starts in four days. Day one would be this coming Friday. Then the weekend. Saturday and Sunday to prepare for Monday. It would be all over on Monday. He'd try to string it out, delay, postpone. But Speyer wouldn't let him get away with any real delays. And then the end.

Stop thinking like that, counselor! Things to do. Check the files. Talk to the technical experts at Welles Engineering. Line up your witnesses. Check the progress of that *Williams* case, presently moving with slow certainty toward certiorari to the Supreme Court. Move for a continuance, first thing Friday, based on *Williams*.

And now he found himself thinking back to the flickering maze. On, off, on . . . Sleep Enterprises—wasn't that a spin-off from Universal Patents? The flickers—how had they gone? On, on, interval, on, on, on, interval, on, long on, on, and again . . . and then he couldn't remember. But it was Morse code. "M . . . O . . . R . . . R . . ." *Morrissey*!

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He hurriedly switched the maze back on. The flashing flickers started up again almost immediately. "F I N D M O R R I S S E Y F I N D M O R R I S S E Y . . ."

It went on for a few more seconds, then the whole image settled down to the original maze. Finally Quentin Thomas shut it off and reached to his night table for his communicator mike.

"Code 9."

"Yes, Mr. Thomas?"

"I want a listing of all amusement and/or educational devices licensed or manufactured by Universal Patents, together with a sublisting of all those involving active mental participation by adults. In each category, make a special indication of a) those that could involve secret encodings, and b) those that appear to have been designed by Faust, the Universal Patents inventing-computer."

"One moment, Mr. Thomas."

He counted forty seconds.

"Mr. Thomas?"

"Here."

"We can provide what you want, though we're not sure we have all material involving possible encodings. The list is lengthy and will require a printout at your terminal. It can begin in about thirty minutes. The price for what we can provide is $37,500."

"I'll take it."

"You have on deposit with us only $25,000."

He thought a moment. "I'm transferring $900,000 to my deposit account." He punched in the numbers in his bank hot line. It cleaned him out—both checking and savings. He wondered if there'd be anything left after the trial.

"Your account is replenished, Mr. Thomas," said the smooth metallic voice. "The printout will soon begin."

He got into his bathrobe and walked into the den to watch the printout.

Games, crossword puzzles, jigsaw puzzles. By the dozens, by the hundreds. All with the message, generally so cryptic you had to first know it was there: "Find Robert Morrissey." And all designed by Faust, the inventing-computer created by Robert Morrissey.

The implications were fascinating.

First there was Robert Morrissey, the remarkable inventor. *He* had designed Faust. And then, somewhere, somehow, Universal Patents had stepped in. Universal Patents now had title to Faust and to Faust's inventions, and was signing Faust's patents as administrator for Robert Morrissey, who was supposed to be insane. And now Faust, in addition to an immense variety of industrial inventions, was cranking out these educational fancies, almost as finger exercises. And all these oddities, in one way or another, kept repeating, "Find Morrissey." And that meant 1) Faust and Morrissey were separated. 2) Faust was concerned about Morrissey's well-being and location. 3) Faust was a living, thinking entity in his own right. 4) And finally, and perhaps most importantly, if 3) were true, then Faust, not Morrissey, was the true inventor of Fiber K. Morrissey was improperly named on the patent as the inventor, and the patent was therefore invalid.

And what could he do with all this?

Nothing, unless he could find Robert Morrissey and/or get Faust into court.

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Fat chance.

He spoke into the communicator. "Code 9."

"Yes, Mr. Thomas?"

"Where is Robert Morrissey, the inventor of the inventing-computer Faust?"

There was a long interval. Then the answer. "We don't know. No charge."

"Where is Faust?"

"One thousand dollars."

"Accepted."

"Faust is in a lead-lined building at Kay and Riviera Drive, Port City."

"Size?"

"Of Faust? One thousand."

"Accepted."

"Twenty-eight thousand cubic feet."

Bigger than the courtroom, mused Thomas. Any way to shrink Faust? Forget it! "Thank you, Code 9, and goodnight."

"It is never night at Code 9, Mr. Thomas, but goodnight to you, anyway."

It is Friday, and a large black electro moves smoothly and swiftly down Riviera Drive toward the Federal Building. On the right-hand door is a tiny insignia, consisting of the words 'Universal Patents' in gold, centered within a circular reticulated silver design that looks much like a spider web. This is the only breach in an otherwise sleek anonymity.

In the back alcove two men sat opposite the little foldout table, putting papers back into their attaché cases. They talked in low voices, more out of habit than to prevent the chauffeur from eavesdropping. He couldn't hear them anyway, with the tinted divider glass down.

"I recognize the extreme importance of this Fiber K case against Welles Engineering," said Jethro Kull, "but I'm also concerned about the *Williams* case. Perhaps you should be in Washington, to handle that thing before the Supreme Court. Your man Jones could take over this Fiber K case until you get back."

"No," said Ordway. "Practice before the Supreme Court requires a specialist—which I am not. In fact, there are only about a half-dozen firms in the country that I consider competent to handle *Universal Patents v. Williams*. We've got the best. With all due respect to Jones, I'm the best for this Welles case. I'm thoroughly prepared. The big thing in Welles is to persuade Speyer to find infringement before the high court can act in *Williams*."

"But will Speyer move it along?"

"Yes, I think so. He's got a crowded docket, and I hear by the grapevine that he's under immense pressure from the chief justice to get an opinion out in a big antitrust case that he's been sitting on for over a year. Of course, Quentin Thomas is sure to move for a continuance, to delay *Welles* until the Supreme Court decides *Williams*."

"What do you think Speyer would do with such a motion?"

"I don't think he'll grant any continuance."

"Why not?"

"A gut feeling."

"Hmm. Not much of a basis for a man who earns his living by logic."

"No."

"Do you know anything about this fellow Thomas?"

"Brilliant, erratic. Twice censured for unethical conduct."

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"Can you handle him, Ordway?"

"With a little help from Speyer, yes."

The limousine pulled into the driveway of the Federal Building underground garage.

"Ordway," said Jethro Kull quietly, "just bear this in mind: if we lose this one, all of our licensees will rise up in revolt. And if *that* happens, our royalty income vanishes, and Universal Patents will soon be bankrupt." He looked straight into the eyes of the lawyer. His voice was smooth as silk, as unruffled as polished granite. "Don't let that happen, Ordway."

His companion swallowed and turned a shade paler. "I understand, Mr. Kull."

"All rise," intoned the bailiff. "The United States District Court for Port City is now in session, the Honorable Regal Speyer presiding."

Judge Speyer entered from his chambers and strode rapidly toward the bench. He carried a large thin portfolio which slapped at his robes as he climbed the three stairs to his big swivel chair. As soon as he was seated the clerk handed up the case file. He checked the caption briefly. *Universal Patents v. Welles*. Right case. He flicked his eyes about the room and spotted Ellen Welles instantly. Marvelous! They always brought in these terminal women, thinking to play on the sympathy of the jury. But he wasn't going to let this case go to the jury.

Now, to get properly prepared. He opened the portfolio and took out his things. He knew his mode of relaxing at the bench sometimes provoked comment. But he didn't care. And it was all very logical.

He was a rotund man, but his arms and legs were thin as sticks. His head seemed joined directly to his shoulders, without benefit or need of neck. Even as a boy he had had a round pot belly. His appearance and surname led quickly to his nickname, "Spider." In youth, adolescence, and manhood he never lived it down. Even today it was not unusual for him to receive official mail addressed to Judge Spider.

Very well, then, The Spider. The opprobrium became first a challenge, and then a victory.

Spiders had become his hobby. He had clasped Arachne to his bosom. And now, even at the bench, even today, in this strange patent case, he lived spiders. He looked down at the paper that he had drawn from his portfolio. It was his custom of long standing that, as he listened to the witnesses and the lawyers, he doodled.

Doodles? No, they were far too sophisticated to be doodles. Laid out flat before him on the bench, between the water carafe and bench case file, was a pad, some eleven by fourteen inches. Each sheet carried a line drawing of a different spider. The arachnids were of course many times life size. The spread of legs was a good six or eight inches. Sometimes the eight-legged creatures were shown on a segment of webbing. Sometimes they seemed to run freely on the ground, betwixt pebble and fallen twig. Sometimes they dangled from a single tiny silken thread.

The plates were prepared by the New England Arachnid Society. What a job they were doing! Nearly seven hundred

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species had been identified in New England. The Society had published this set of line drawings. The buyer was supposed to color the drawings according to a code provided on the plate.

And what have we here today? he thought.

Atropos. A newly discovered species, evidently a mutant from Klotho via Lachesis. Only one hundred specimens known to exist. He had one, of course. In his terrarium back in his bachelor quarters. There was something special about the filament. Atropos sensed when its web had caught a fly because of tiny electric currents that went up the core of the silk to the nerve center of the web. Or so they said.

As soon as things got going here, he would dip the water color brush in the little water well, touch the brush to the cake of cobalt blue, and begin filling in the central band around Atropos's abdomen. And then the two bands of vermilion.

Once more, with great satisfaction, he sought out the head and eyes of Ellen Welles. He couldn't ask for better. He thought about his antitrust case, *U.S. v. Systems Motors*. It was as good as written. This woman would die, and watching her die would give him the mental energy he needed for *Systems*. His *Systems* opinion would turn out to be a major contribution to antitrust law. The law review journals would analyze it for months. He rubbed his hands together with great satisfaction. Hang in there, Atropos, it's going to be a fine day.

And now to business.

He swiveled his high-backed chair toward the jury box. "I am required by law to make this opening statement to you. You, the jury, are sitting in an action for patent infringement. Counsel for plaintiff, Mr. Ordway, in the green robe, sits at the table nearest you. Counsel for defendant, Mr. Thomas, in the red robe, sits at the far table. In addition, at defendant's table sits a person dressed in black. This person is called an oblate, and I will come to that."

He surveyed his courtroom. Packed. You could get in only by special ticket. He had seen the rules drawn up by the Committee of Clerks. First, representatives of eighteen foreign patent offices. Then the bar association selections, then about two dozen amici curiae. Then the technical associations: the ACS, AiChE, ASME . . . the whole alphabet-soup schmear. The NAM wanted to enjoin the further operation of the invention machine as destroying the national economy. The Department of Justice wanted to put all the machine's inventions in the public domain. The Commissioner of Patents had filed a three-hundred page a.c. He knew from the abstract that the Patent Office was urging invalidation of its own patent. Odd. Not that it mattered. And then, the press. And finally, of course, the TV crews, who would carry the whole incredible mess to a quarter of a billion viewers all over the world.

He continued. "Approximately four hundred suits for patent infringement were brought in the federal courts in the last decade of the twentieth century. Every one of the patents involved was found invalid. In most of the cases, the plaintiff was required to pay all costs, including fees of defense counsel. As a consequence, not one complaint for

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patent infringement was filed in the first year of the present century. In fact, during that period, patent applications filed in the U.S. Patent Office dropped by nearly 95 percent. The patent system, so long a cornerstone of our pattern of free enterprise and innovation, was dead."

Quentin Thomas looked at the thirteen faces on the jury, including the alternate, a pleasant-looking grandmother. Did any of them understand what Speyer was telling them? No way to know. Six men. Six women, plus the alternate. Working people. Retirees. Housewives. That pregnant woman. How in God's name did she ever get on the jury list . . .

"The Congress responded," continued the judge, "by passing the Patent Act of 2002. This new Patent Act makes two very drastic changes in the former patent laws. First, the defendant is presumed guilty of the charge of infringement until he proves his innocence. Second, patent infringement is a criminal offense: it carries the death penalty."

A loud buzzing suddenly burst up from the room, like a swarm of noisy insects taking flight. Judge Speyer banged the bench with his gavel. As the drone died away, he spoke succinctly. "I will have an orderly court. If I find that that is not possible, the public will be excluded."

A sudden quiet fell.

"As originally proposed," he continued, "the new Patent Act designated the chief executive of the infringer as the party subject to the death penalty. It was evident that Congress had in mind a corporation president or chairman of the board. As the subsequent case law developed, however, it became clear that the penalty was assignable. All the company president needed to do was to find a person willing to assume the risk. We call this person the *oblate*." He studied his notes for a moment, then looked over toward the defense table. "Mrs. Welles?"

Ellen Welles started to rise. "No," whispered Thomas. "Just say, 'yes, your honor', and answer his questions."

She sat down nervously. "Yes, your honor."

"You are the oblate?"

"Yes."

"You understand that if a verdict of infringement is found, you will be required to drink a solution of one gram of potassium cyanide dissolved in water?"

"I understand, your honor."

"And if you should be adjudged guilty, but refuse to drink the solution, you will be physically restrained, and you will then die by forcible injection of cyanide. Do you understand that?"

"Yes, your honor."

"Alas," said Speyer unctuously, "we are required to place a price on that which is priceless. So I must ask you, have you posted the required bond for your appearance here, each and every day of this trial?"

"I have, your honor."

"This bond is all assets of Welles Engineering Corporation?"

"It is, your honor."

"If you should fail to appear, you understand that your bond will be forfeit, and in addition, you must still drink the poison, and finally, failing that, you

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must die by forcible injection of cyanide?''

''Yes.''

''This trial may require two, possibly three days. Do you expect to live that long?''

''So I am told by my doctors, your honor.''

He studied the medical report in the case file. Her doctors gave her one to six months. The point was crucial. She had to live long enough for him to pronounce sentence. She had to live long enough to die. Interesting paradox. He wondered if she would appreciate it. Probably not. ''You will be survived by—''

''A daughter, your honor. Age thirteen.''

''Yes. I see. Well, then, I pronounce you to be a satisfactory oblate. You must now wear a hood at all times during these proceedings. Have you brought your own, or do you want the bailiff to provide one?''

Quentin Thomas handed her the black hood. She said, ''I have my own, your honor.'' She pulled it over her head like a loose flimsy ski mask and looked up at Speyer through half-hidden eyes.

''Let's get on with it,'' said Speyer. He looked over the dais to the bailiff. The bailiff nodded. Speyer continued. ''At this point, by virtue of Local Rule of Court No. 140, we shall have The Test. Bailiff, are you prepared to carry out The Test?''

''I am, your honor.''

''Raise your right hand.''

The bailiff raised his right hand.

''Do you swear to make The Test faithfully and in accordance with law?''

''I do.''

''Please proceed, describing each step for the record.''

''Yes, your honor.'' He pulled on a pair of rubber gloves, and his voice shifted into a sort of sing-song. ''First I mix out eight fluid ounces of distilled water into this drinking glass. Then I take this weighing balance. I set the scales at one gram, and I place a filter paper on the weighing pan. Then I take this brown bottle, which contains chemically pure potassium cyanide in the form of a white powder, and I shake out enough potassium cyanide onto the filter paper to make the scale balance. Then I empty the contents of the paper into the glass of water, and stir with this glass rod until it is all dissolved.''

Quentin Thomas looked at the masked woman from the corner of his eye. He knew she was watching this with rapt attention, but he could only guess at the expression on her face. Was it fascination? Fear? Horror?

''That,'' said the bailiff, ''is part one of The Test. Next, from the glass I pour a little of the solution into this little dish, and in a moment I shall slide the dish into this cage.'' He motioned to a screened cage on a serving cart. ''The cage contains a mouse which has had nothing to drink for three days. Owing to the requirements of confinement, a closed circuit TV system will show events within the cage not otherwise visible.'' The lights within the courtroom dimmed as a luminous picture lit up the far wall opposite the jury box.

In the picture was a creature—a mouse—many times life size. They saw the tray of poison-water slide through a slit in the front of the cage. The little creature drew back at first, then sniffed

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in the direction of the liquid. An eerie silence fell over the courtroom. And now the mouse crept forward slowly, fearfully, put its head over the lip of the dish, drank a sip or two, backed off, collapsed, and expired amid convulsions that knocked over the drinking dish.

The bailiff opened the top of the cage, picked up the little mammal by the tail between gloved thumb and forefinger, and showed the test product first to the judge, then to the jury.

"Thank you, bailiff," said Judge Speyer.

Quentin Thomas had seen all this once before. It had revolted him then, and it revolted him now, to the point that his hands trembled. The thing that got to him wasn't the death of the mouse. Not that. Or even the possibility that this woman might have to drink from that glass. No, the thing that threatened to dissolve his intestines was a tiny sliver of saliva making its way down Judge Speyer's chin. And the way Speyer was staring at Ellen Welles. As though Speyer was a boa constrictor coiling slowly towards a hypnotized rabbit.

Life seemed to be flowing back into the room. The bailiff dropped the test animal back into its cage, went over to the chrome-lined glass box that contained the poison drink, closed the lid, snapped the lock, and placed the assembly on the judge's bench, next to the coloring book. He then wheeled the mouse cart out of the back of the room. As the door closed behind him, Judge Speyer turned to the jury with a smile. "At this point it is customary to mention that a sterile hypodermic syringe rests in its plastic sheath, next to the aqueous cyanide."

The bastard! thought Quentin Thomas. *He's looking straight at Ellen!*

"To be used, of course," finished Speyer, "only in the event of forcible restraint. And that completes The Test. I trust we are all impressed with the solemnity of the occasion. So, let us get on with the trial. Are there any motions? Mr. Ordway?"

Ordway stood up. "No, your honor."

"Mr. Thomas?"

Defense counsel pushed his chair, flicked his red robe aside, and got to his feet. "Your honor, I move to postpone this trial until the United States Supreme Court decides *Universal Patents v. Williams*. As your honor is probably aware, *Williams* is a patent infringement case similar in its facts to this instant litigation, and with the same plaintiff. In *Williams* the defendant lost, but moved for a stay of execution pending review by the Court of Appeals for the Ninth Circuit. The Court of Appeals, however, refused to hear the appeal, noting that the language of the Patent Statute gave no right of appeal. Thereupon defendant petitioned certiorari to the Supreme Court to review the single question of whether denial of appeal rendered the entire statute unconstitutional. The present posture of that case is that the petition for certiorari is before the high court and the court is expected to decide within the next few days whether it will grant the petition. If it grants the petition, as is indeed anticipated, the Supreme Court may be expected to hand down its decision the following day."

"Mr. Ordway?" said Speyer.

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"Well, your honor, I oppose, of course. In the first place, there is no firm evidence that the Supreme Court has the petition before it. But assuming it has docketed the petition and will vote in due course on whether to grant it, it is sheer speculation on our part that the high court would find the Patent Statute unconstitutional. I respectfully submit that such possibility is highly unlikely. Considering the remoteness of the possibility, a continuance is not justified. So I oppose."

"For the moment, Mr. Ordway, I'll agree with you. I deny defendant's motion for a continuance. However, Mr. Thomas, I grant you leave to renew your motion if and when the Supreme Court does in fact grant certiorari to *Universal Patents v. Williams*."

"That may be too late, your honor," protested Thomas, his red robe swirling indignantly. "It's just a matter of a few days. Surely this case can wait two or three days? I ask your honor to reconsider."

"Let the record show that I have reconsidered," said Speyer coolly, "but without changing my decision. Your motion is denied, Mr. Thomas."

"Yes, your honor." He sat down. He had expected nothing else.

"Now then," said Speyer, "does plaintiff have an opening statement?"

"Yes, your honor." Ordway swept his green robe around his body in an elegant swirl as he rose to face the jury. "Ladies and gentlemen, as Judge Speyer has told you, this is a patent infringement suit. By the simple act of filing a complaint in this court, my client, Universal Patents, has established a presumption that the defendant, Welles Engineering Corporation, infringes our patent. Our patent covers a remarkable synthetic fiber, remarkable in that it conducts electric current. The Welles Corporation makes and sells such a fiber, which they call Fiber K, and thereby they are presumed to infringe our patent. This presumption is rebuttable. By this we mean that it's up to Welles to show that they don't infringe, or that our patent is invalid." He paused to cast a contemptuous glance toward the defense table. "They have hired a very brilliant lawyer, Mr. Quentin Thomas, who will try very hard to convince you that our patent is indeed invalid, or not infringed, or both. But we think you will find that the evidence he will adduce is insufficient." He looked down at his table top and coughed delicately. "Now, as Judge Speyer has told you, patent infringement carries the death penalty. If the defendant loses, sentence is passed, and a person designated as the oblate will die before your very eyes. Don't let this possibility influence your thinking, ladies and gentlemen, especially since Mrs. Welles is terminally ill, and due to die any day, any hour. Thank you." He bowed to the jury, then to Speyer, and sat down.

"Mr. Thomas?" asked Speyer.

"No opening statement, your honor."

"Very well then. Call your first witness."

The defense lawyer looked out over the sea of faces. "I call Ronald Flagman."

A man arose from the audience, pushed his way to the aisle, and strode up through the courtroom toward the witness stand, where the bailiff swore him in. He stepped up onto the stand.

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"Please state your name," said Thomas.

"Ronald Flagman."

"What is your current employment?"

"Commissioner of Patents, United States Patent Office."

"Mr. Flagman, in your capacity as Commissioner of Patents, do you receive patent applications from inventors throughout the world?"

"I do."

"I show you a copy of Plaintiff's Exhibit 1 for identification, United States Patent 6,005,022, and I ask you to note the name of the inventor."

"On the patent's face," said Flagman, "it states, 'Robert Morrissey, by his Administrator, Universal Patents.' "

"Are you aware that the actual inventor is a computer-machine named Faust?"

Ordway was on his feet, his green robes shuddering in outrage. "Objection! The question assumes several facts not in evidence, namely that something called Faust exists; that Faust is capable of invention; that Faust did in fact make the invention in question; and that Mr. Morrissey did not make the invention."

Speyer looked up from his coloring book. "Sustained."

Quentin Thomas smiled faintly. "Have you ever heard of something called Faust?"

"Yes."

"In what connection?"

"I've read the newspaper and journal articles. I've heard the commentator reports on TV and radio."

"Do these reports describe Faust as an inventing-computer?"

"Objection," said Ordway. "Leading."

"Sustained," said Speyer.

"Mr. Flagman," persisted Thomas, "how do these reports describe Faust?"

"Objection. Hearsay," said Ordway.

"What the witness has heard with his own ears is admissible, your honor," said Thomas. He added smoothly, "I offer not for the truth of what he heard, but for the fact that he heard it." If he got the point in at all, under any guise, he knew—and Ordway knew—that the jury wasn't going to keep this subtle distinction in mind.

"Objection overruled," said Speyer. "You may answer, if you know. Will the reporter repeat the last question?"

Ordway flashed a piercing glance of hatred at Quentin Thomas, who smiled back.

The reporter held up a length of paper tape from his steno machine and read: " 'Mr. Flagman, how do these reports describe Faust?' "

"As an inventing-computer," said the Patent Commissioner.

"Do the reports say anything else?"

"Yes. According to the reports, Faust was assembled by Robert Morrissey and Faust files a great many patent applications in the Patent Office."

"Is this also *your* understanding, Mr. Flagman?"

"Objection," said Ordway. "It has not been established that the witness has personal knowledge that anything was assembled. Also, the question, as phrased, is compound."

"Sustained," said Speyer.

"Mr. Flagman," continued Thomas, "does the Patent Office receive a great many patent applications from Robert Morrissey by his administrator, Uni-

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versal Patents?''

''Yes.''

''Can you explain in a general way what procedures the Patent Office follows in examining the patent applications it receives from Universal Patents?''

''The same as for all applications, Mr. Thomas.''

''Which is—?''

''First, our clerks check each application to make sure that all the parts are there: specifications, claims, declaration of inventorship by the applicant, and the filing fee. If the cover letter mentions drawings, the receiving section verifies the number of sheets of drawings.''

''What next?''

''The application is routed up to the classification branch. There, technical experts determine what technology it relates to. For example, is it electrical, chemical, agricultural, and so on. Following this determination, it is routed to the proper group for examination.''

''What happens when it reaches the 'proper group'?''

''It is sub-classified. Which is to say, within that group it is assigned to the patent examiner who handles the exact art in question. Say it goes to the organic chemistry group. Well, there you have a further breakdown into dyes, polymers, steroids, and so on. The designated examiner puts it at the bottom of his stack, figuratively speaking. He takes his cases up in turn. When a case comes up for examination, he makes a search to determine if it is novel and unobvious.''

''How does he make this search?''

''There are two methods: hand search and machine search. He might use either or both. It's up to him, at his discretion.''

''What is the hand search?''

''The examiner looks at certain select files in the Group search room. We call these files 'shoes'. Some of these files are extremely extensive and go far beyond what we have in the public search room on the main floor of the Patent Office.''

''And how about a machine search?''

''That's simply done by computer. The examiner can 'plug in' several key words, such as 'polyamide', 'electrically conductive', and so on, and see what references the computer can extract from its data banks.''

''What represents the general input into the data banks of the Patent Office computer?''

''It is fairly broad. We have a reciprocity arrangement with all the patent offices of the examining countries throughout the world. Also we have the major technical journals.''

''Have you seen any reports regarding Faust's data bank?''

''Yes.''

''How does the Patent Office computer compare, as regards data bank input?''

The Commissioner shrugged. ''We have studied that. Our estimate is that we get about one-third of the technology, and that our time lag in getting it into our computer is about ten months as compared to no lag at all for Faust.''

''Please explain, Mr. Flagman.''

''Well, the technical journal budget of the Patent Office Scientific Library gives us access to about one-third of the journals available to Faust.''

''But how about the time lag? Are

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you saying it takes the Patent Office ten months to get data out of a given journal and into your computer?''

''Yes. This is done by a group of professional abstractors. They read the journals, abstract what they think important, transfer it to punch cards, and from there it enters the computer data bank library. Faust, of course, has a built-in reader. He scans the literature electronically. His input is instantaneous.''

''*His* input, Mr. Flagman?''

''I spoke figuratively, Mr. Thomas.''

''Can't the Patent Office install an electronic reader?''

''We have been looking for one. Actually, you can't just go out and buy one off the shelf. To have a reader designed and manufactured specifically for the Patent Office computer would cost about ten million dollars. We have asked for this money in our budgets submitted for each of the past five years, but so far Congress has not seen fit to give it to us.''

''In what year was the first application filed by Mr. Morrissey?''

''So far as our records show, it was 2003.''

''Did Mr. Morrissey sign the declaration himself, or was it executed by his guardian, Mr. Kull?''

''Mr. Morrissey signed it himself.''

''Did he make that invention by the use of Faust?''

''I don't know.''

''When did Mr. Kull start signing as administrator for Mr. Morrissey?''

The Commissioner checked his notes. ''In 2005.''

''How many patent applications did Mr. Kull file that year, as Mr. Morrissey's administrator?''

''Ninety-six.''

''And how many did he file last year?''

''About twenty thousand.''

''What was the total for all patent applications filed last year?''

''Twenty thousand, five hundred.''

''Twenty thousand, five hundred.

''So he filed about 97% of all the patent applications received by the Patent Office last year?''

''Yes.''

''Mr. Flagman, have you had occasion to check with foreign patent offices on this point? By this I mean, is it also the experience of foreign patent offices that Universal Patents is filing most of the patent applications that are being filed in their countries?''

''Yes. It is approximately the same, at least in the countries that have an enforceable patent system.'' He looked at his notes. ''In Japan 90% of the applications are filed by Universal Patents; in West Germany, 95 percent; in the United Kingdom, 94 percent . . .''

Ordway stood up. ''Your honor, I object to this line of questioning. The percentages of patent applications filed by plaintiff throughout the world are completely irrelevant to the two central issues in this case, which are, is the Fiber Patent valid, and does defendant infringe it. Even if one could predict that Universal Patents will file one hundred percent of the patents that are filed starting next year, and even if you assume that Universal Patents will eventually own all new and useful technology by next year, it would all be irrelevant to any issue in this case.''

''Objection sustained,'' agreed

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Speyer. "The jury is instructed to ignore defendant's line of questioning involving plaintiff's percentage of participation in world patent filings."

Quentin Thomas lifted his shoulders very slightly. So much for monopolization of the Patent Office by Universal Patents. But he had by no means exhausted Flagman's possibilities. He said, "Mr. Flagman, did the Patent Office file an amicus brief in this case?"

"We did."

"Who actually wrote it?"

"I did."

"Did you make a recommendation?"

"Yes, sir."

"What was it?"

"We asked that the court find the Fiber Patent invalid."

"Invalid? On what basis does the Patent Office think one of its own duly issued patents is invalid?"

"Objection," said Ordway. "Mr. Flagman's answer will necessarily be conclusory and speculative."

"Overruled," said Speyer. "You may answer, Mr. Flagman."

"The Patent Office has contended for several years that patents generated by a computer, especially by a program based on negative selection, are invalid."

"Objection," said Ordway. "The question assumes as a fact that Faust, as a computer, not Morrissey as a human being, made the Fiber K invention."

"Not at all," countered Quentin Thomas. "The question is simply directed to a procedural point within the Patent Office."

"Objection overruled," said Speyer. "You may answer, if you know."

"Well, in our treatment of computer-associated inventions in the Patent Office, we are necessarily guided by two milestone decisions. We call them Morrissey I and Morrissey II."

"Perhaps you'd better take those up one at a time," said Thomas. "What was involved in Morrissey I?"

"The issue there was whether a patent could be granted on a machine search reporting output in terms of negative selection."

"Explain 'negative selection'."

"One example would be this. Suppose the literature shows performing a certain process using methanol, ethanol, and butanol, but with no mention of propanol. By the process of negative selection the computer selects propanol, which of course lies between ethanol and butanol in the homologous series of alkanols. That's the computer's new invention, carrying out the old process, but using propanol. And that's what we in the Patent Office call negative selection."

"Does negative selection require the abstract act of invention?"

"In my opinion, no."

"Has 'negative selection' ever been tested in court?"

"Yes. That's what we call Morrissey I. It originated as *Ex parte Morrissey*, before the Patent Office Board of Appeals, in 2005. The Board held that as a matter of law, negative selection could not qualify as invention. The claims were rejected. Universal Patents appealed to the Court of Customs and Patent Appeals, which reversed the Patent Office and held that negative selection *could* qualify as the inventive act. The CCPA spelled this out in 2006. First,

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they required the Patent Office to look at the invention as defined in the claims, without regard to whether the invention had been made by a computer or directly by human intuition. Secondly, the decision held that the process of negative selection does not in itself destroy invention."

"Has the Patent Office rejected any of Faust's patent applications since that time?"

"Yes, on several occasions."

"On what grounds?"

"Well, after Morrissey I, we abandoned negative selection as a basis for rejection. Thereafter, the ground was obviousness."

"What do you mean by 'obviousness'?"

"We relied on the definition in the Patent Statute, to the effect that, if the differences in the claimed invention and the closest prior art were such that the invention would be obvious to one skilled in the art, the alleged invention was unpatentable."

"A subjective judgment?"

"Yes."

"What happened to Faust's applications that you rejected for obviousness?"

"Universal Patents abandoned about half. The other half, they took to the CCPA. They got a reversal in about 30 percent of their appeals."

"How do those numbers compare with your averages for other inventors?"

"About the same, although you must appreciate the fact that the remaining inventors are fewer in number and present a much smaller sample."

"Now, Mr. Flagman, you testified that the Patent Office has, or had, a computer capable of making a machine search of the prior art. Have you ever tried to extend its capability?"

"Yes. We had it modified in an attempt to turn it into an inventing computer."

"How did you do that?"

"Well, for one thing, we hard-wired it to use the principle of negative selection."

"But hadn't the CCPA already instructed the Patent Office not to reject on negative selection?"

"Yes, but this was different. We wanted to *demonstrate* that any computer, properly modified, could come up with inventions resulting from the principle of negative selection, and that, therefore, the alleged invention lay within the public domain and could not be the subject of a monopoly."

"Proceed. What result?"

"We had problems. In the first place, as I have already mentioned, our machine did not have nearly the data bank resources that Faust had. Also, there was a severe time lag in our case. The modifications proved inadequate to prove our point. To cope with Faust, we needed another Faust, a twin, at a cost far beyond our means, even assuming that we had Mr. Morrissey available to build it for us. We disconnected the modification several years ago. The basic computer will still make a routine machine search, but it doesn't try to invent any more."

"Why not?"

"Because of Morrissey II."

"What about Morrissey II?"

"Faust filed a patent application on a new alloy. Our modified machine

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searched the literature. The new alloy wasn't in the literature. It was at least literally novel. We then tried the concept of negative selection on our machine. We assumed that it was by this procedure that Faust 'conceived' the new alloy, by adding a metal component that the prior art had missed."

"And did your machine find the missing metal?"

"No, our machine missed it. But we rejected the patent application anyhow, on the general ground of obviousness."

"What happened next?"

"Universal Patents appealed. First to the Patent Office Board of Appeals. The Board confirmed the Examiner's rejection. And then Universal appealed to the CCPA."

"The Court of Customs and Patents Appeals," said Quentin Thomas. "What happened there?"

"They reversed us."

"On what grounds?"

"Well, this is the famous decision in Morrissey II, which I mentioned earlier. The court said that since Faust had found the alloy, and since the Patent Office computer, though wired to invent, had *failed* to find it, this was clear evidence that Faust—or Morrissey—had transcended the skill of the art, and they held the alloy unobvious."

"They were using the inadequacies of your machine as proof of unobviousness of Faust's invention?"

"Objection, leading," said Ordway.

"Overruled," said Speyer.

"That's the way it looked to us at the Patent Office," said the Commissioner.

"And that's why you disconnected the modification to your computer?"

"Exactly. We simply returned it to its normal examining function."

"Thank you, Mr. Flagman. I have no further questions." He returned to his table, aware that Ellen Welles's eyes were searching his face through the slits in her hood. There was nothing to say. Had he been able to cast a little doubt as to the validity of the Fiber Patent in the mind of at least one juryman? No way to know.

"Any cross, Mr. Ordway?" said Speyer.

"Just a couple of questions, your honor." He walked up to the podium, his green robes trailing in grandeur. "Mr. Flagman, does the Patent Office computer have a mind, a being, a soul of its own?"

"Not that I know of."

"It's just a very intricate piece of electronic hardware?"

"Yes."

"As is every computer?"

"Yes, so far as I know."

"You have mentioned hearing reports about a computer named Faust?"

"Yes."

"And you've mentioned reports to the effect that one Robert Morrissey invented Faust?"

"Yes."

"And that Faust is supposed to have invented applications being filed in the Patent Office by Robert Morrissey?"

"I've heard that."

"As a philosophical point, Mr. Flagman, as between Morrissey and Faust, who is the inventor of inventions flowing from Faust?"

"Objection, speculation," said Thomas.

"Mr. Flagman's opinion is asked as an expert in the field of invention," re-

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torted Ordway. "There's no speculation."

"Objection overruled," said Speyer. "You may answer, Mr. Flagman, but you must give the basis for your conclusion."

"As between Morrissey and Faust, Morrissey is the inventor, and the reason is, Faust is but a machine conceived and assembled by Morrissey. When Faust speaks, it is actually Morrissey speaking."

Damn! thought Thomas. There goes the ball game. He ignored Ordway's twisted triumphant smile.

"That's all I have," said Ordway.

"Re-direct, Mr. Thomas?" asked Speyer.

"Yes, your honor." He addressed the Commissioner of Patents. "Mr. Flagman, suppose Mr. Morrissey were dead, but his computer continued to invent as programmed. Is Mr. Morrissey the inventor of these posthumous inventions?"

Ordway jumped up. "Now *that's* speculation, your honor! I object!"

"It's directed to Mr. Flagman's opinion as an expert in the field of invention, to use Mr. Ordway's words," said Quentin Thomas.

Speyer shrugged. "Overruled. Answer if you can, Mr. Flagman."

"Mr. Morrissey would still be the inventor," said the Commissioner.

The defense lawyer pressed on. "Now, suppose Faust keeps inventing. It's now ten years after Morrissey's death. No one modifies Faust's circuits. He's just as Morrissey designed him. Is Morrissey still the inventor of Faust's output?"

"Yes. The cases would be filed in the name of his estate, of course, by his personal representative."

"Make that one hundred years later, Mr. Flagman. Who's the inventor?"

"Morrissey," said the patent official doggedly.

"One thousand years, Mr. Flagman?"

"I think we are moving into a very unclear area, sir."

"Well, let's try to clear it up, Mr. Flagman. Is Mr. Morrissey, through his computer, immortal?"

"I don't think I can answer that, Mr. Thomas."

"So there might be a dividing line? A point in time at which Morrissey ceases to be the inventor, and after that, Faust is the inventor?"

"Possibly."

"Can you say with absolute certainty that that point had not been reached when Faust filed the patent application for Fiber K?"

"No, I can't."

"So Faust might possibly have been the true and sole inventor of Fiber K?"

"I don't know, Mr. Thomas. I just don't know."

"I appreciate the difficulties here, Mr. Flagman. Let's get back to well-known legal principles. If Faust *were* the sole inventor, and not Morrissey, would the patent be valid"

"No, in that case it would be invalid. The correct inventor must be named."

"Thank you, Mr. Flagman. I have nothing further."

"Re-cross, Mr. Ordway?" said Speyer.

"No, your honor."

"You may stand down, Mr. Flagman," said Speyer. "And now, since it's approximately noon, we'll have a

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recess. The court will adjourn until one-thirty.''

''All rise,'' intoned the bailiff. ''This honorable court is now in recess.''

After Speyer had left the room, Quentin Thomas helped Ellen Welles remove her mask.

''What do we do with this thing?'' she asked.

''I'll keep it in my attaché case,'' he said gravely. ''You'll need it again when trial resumes. Local rule something or other.'' He removed his robe and stuffed it into the case along with her hood.

''What now?'' she asked.

''Let's go out for a bite to eat.''

Ellen Welles stared gloomily into her cup of soup. ''I guess we didn't do too well with Flagman.''

''No,'' said Quentin Thomas. ''But then, he didn't know very much. What we did get from him was the official position of the Patent Office, that the Fiber K patent is invalid.''

She was silent.

''We don't have much time for lunch,'' he said. ''You'd better eat something.''

''I'm not hungry. Who are you going to call as your next witness?''

''Jethro Kull.''

Her eyes widened. ''You mean you can actually get him up there on the stand?''

''You bet. We have already subpoenaed him.''

''That should be interesting. Maybe I *will* eat something.'' She dipped her spoon into the broth.

''Mr. Kull,'' said Quentin Thomas, ''by whom are you employed?''

The heavy-set man looked down at him from the witness stand. ''Universal Patents.''

''In what capacity?''

''President and Technical Director.''

''Do your duties bring you into contact with the computer-inventor which goes by the name of Faust?''

''Yes.''

''In what way?''

''Well, among other things, I supervise Faust's utilization, maintenance, and repair.''

''Looking simply at utilization, please explain just what that entails.''

''I select the technical literature that he reads. Faust keeps current with about forty broad fields of technology: chemistry, electronics, mining, metallurgy, space vehicles, and so on. We subscribe to all the serious technical journals in these fields.''

''You abstract these for him?''

''Oh, no. He reads them directly. We feed it into the slot. Zot! Flip, flip, flip. Every line, every page. All languages.''

''And then what?''

''Then he invents. Based on the total technology in his data banks, he invents.''

''Several inventions a day?''

Kull laughed. ''Mr. Thomas, he cranks out about one thousand inventions a day!''

''So many? But not all of these are filed in the Patent Office?''

''No. He screens the gross output. He selects those of greatest value to society and industry. If a given invention looks as though it will be of reasonable value, he files it in the Patent Office.''

''How many is that?''

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"It averages about one hundred a day."

"What is the filing fee charged by the Patent Office? How much per patent application?"

"One hundred dollars per application."

"So it costs you—your company—ten thousand dollars a day just for filing expenses?"

"Yes, sir."

"Over two million dollars a year?"

"Well over."

"But you get this back in your licensing programs?"

"We do."

"You have heard testimony of the Commissioner of Patents to the effect that Morrissey—or Faust—or Universal Patents for the past several years has filed over ninety percent of the patent applications that are filed in the United States and in other industrial countries. Are licenses available under all of these patents?"

"They are indeed."

"By reason of this proliferation of patents, has Universal Patents acquired control of any substantial sector of American industry?"

"Objection!" Ordway was on his feet and hitching up his green robe as though to avoid contact with so contaminating an inquiry. "Irrelevant!"

"Overruled," said Speyer.

"We have a certain amount of control over certain limited areas," admitted Kull.

"Isn't it a fact, Mr. Kull, that your patent structure covers every significant innovation introduced in industry since Faust began to invent?"

"Every? I don't know about *every*."

"*Most* of the innovations?"

Ordway was up again. "Your honor, I object. Universal Patent's contributions to American industry are not at issue here. Furthermore, the question calls for a quantifying answer, necessarily involving considerable speculation by the witness."

"Your honor," said Quentin Thomas, "we are attempting to show that plaintiff is attempting to monopolize all basic industrial technology through its patent structure. This is a concerted, long-enduring program which in itself constitutes an unreasonable restraint of trade, thereby violating the Sherman Antitrust Act. It is part of defendant's defense that even if the patent is valid and infringed, it is unenforceable for reasons of public policy. Plaintiff should not be permitted to kill this woman in pursuit of its technological stranglehold on the United States and indeed on the whole world!"

"I object to the inflammatory language, your honor," said Ordway harshly. "And I offer a continuing objection to testimony tending to show plaintiff's ownership of technology other than that at issue here. Such testimony is simply irrelevant."

"I will sustain your objection to Mr. Thomas's last question," said Speyer. He addressed defense counsel. "Now then, Mr. Thomas, please put the world conspiracy out of your mind. Move on to something more relevant."

Thomas turned back to the witness. "Mr. Kull, do your prospective licensees in industry ever resist your licensing terms?"

"Your client is resisting right now, Mr. Thomas."

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A wave of nervous laughter floated over the audience. Speyer banged away with his gavel. "Please continue, Mr. Thomas."

"Have you ever taken over a licensee who could not pay your terms?"

"Objection!" roared Ordway.

"Sustained." said Speyer. "I must caution you, Mr. Thomas, I will not have this trial turned into an *ad hominem* attack against the patentee."

"Of course not, your honor. As a matter of fact, I have the greatest admiration for the patentee, Mr. Robert Morrissey." He turned back to the witness. "Mr. Kull, why is Mr. Morrissey not present here today?"

"Because he is presently confined to a sanitarium for the mentally ill. He is incompetent."

"And yet he files one hundred patent applications a day?"

"Yes."

"His mental condition does not seem to affect his inventive abilities?"

"Well, Mr. Thomas, I think you know the story there. He invented Faust, and then he became insane. The inventive capacity of his computer-inventor was brought into being before he had his very lamentable mental lapse."

"Has a legal guardian been appointed for him?"

"Yes, sir."

"Who?"

"Myself."

"Who gets the money from the patents?"

"Well, of course, it's put in trust for Mr. Morrissey."

"Who is the trustee?"

"Universal Patents."

"Is there an instrument setting up the trust?"

"Objection!" said Ordway.

"Sustained," ruled Speyer. "Mr. Thomas, income from other patents has nothing to do with infringement or validity of the Fiber Patent. This whole line of inquiry is irrelevant. You are wasting the court's time."

He would have to come in from another direction. "Mr. Kull, is it your testimony that Faust simply looks at the literature, and then comes up with his ideas?"

"Some of his inventions are made that way. For others, he conducts experiments."

"In a laboratory?"

"In a sense, yes. Faust carries within himself several laboratories."

"Chemical? Electronic?"

"Both. Faust contains a tiny chemical laboratory within his shells, with all standard pieces of laboratory equipment and analytical machinery, plus several hundred thousand chemical reagents. His chemical inventions are always tested in his laboratory before he files a patent application. And since he requires only a few hundred molecules to make a test, each test takes only a microsecond. Faust can conduct a chemical research program in ten minutes that would require several years for a conventional corporate laboratory."

"Does he contain anything else, Mr. Kull?"

"Faust has a tiny electric smelter, plus a stock of thousands of different metals and alloys. He has a permutative electronic circuit board capable of an almost infinite variety of circuits. He makes his own paper from the air: it is carbon-dioxide based, of course. And

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he has a small nuclear reactor, plus some other things."

"And you contend, Mr. Kull, that all this work, these experiments, these ideas, all of these are the inventions of a man in a mental institution?"

"Yes, sir. For Mr. Morrissey built Faust."

This was getting him nowhere. He had to try something else. "Mr. Kull, you heard Mr. Flagman's testimony to the effect that Faust filed about 20,000 patent applications in the United States Patent Office last year. Do you recall that?"

"Yes, it was about 20,000."

"But we don't have a figure for this year. Say, for the first six months. Can you provide that?"

Kull hesitated. Quentin Thomas noted that the big man suddenly looked uncomfortable. Aha, he thought. Possibilities? At last?

"He filed about five thousand," said Kull.

But that, thought Thomas, was the quota for only one quarter. Say, February, March, and April? His heart leaped. This was it! "When did Faust stop filing?" he asked quietly.

Kull shifted in the witness chair and looked over at Ordway as though for guidance. But Ordway seemed to have his eyes fixed on his papers.

Kull said finally, "I don't recall exactly."

"Perhaps not exactly. But isn't it true that Faust did not file anything in the month of June?"

"Yes, I guess so."

"Nor in May?" Thomas continued. "And very few, if any, in April?"

"That is correct."

"Why not, Mr. Kull? Did you turn him off?"

"No, we didn't turn him off."

"Did Faust explain his inactivity to you?"

"In a way."

"What did he say?"

"It doesn't make any sense."

"Let the jury be the judge of that. What did he say?"

"Faust claims he is through inventing within the field of industrial technology. He claims he is going on to other things."

"What other things?"

"Five things," said Kull tautly.

"Please name them, Mr. Kull."

"Well, first, the cure of certain diseases. Second, changing the size of objects. Third, transport of objects. Fourth, projection of the future into the present. Fifth, telekinetic control of certain chemical reactions."

Quentin Thomas had to pause to digest this. Was Kull serious? The U.P. president and technical director seemed deadly serious, and somewhat chagrined at having to reveal the shortcomings of the computer-inventor in open court. Thomas said, "Has Faust demonstrated any of these new projects?"

"No, of course not. I told you it wouldn't make any sense."

"I have nothing further," said Thomas.

"Cross, Mr. Ordway?" said Speyer.

"No, your honor."

"You may stand down, Mr. Kull," said Speyer. "And I think we may as well recess for the weekend."

"Your honor," said Thomas.

"Yes?" said Speyer impatiently.

"Just one further matter, your honor.

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Defendant would like to have Mr. Robert Morrissey testify, if he can be found. We assume that Mr. Kull, as his guardian, knows where he is. Mr. Kull is in the courtroom just now, and I will ask the court to order Mr. Kull to produce Mr. Morrissey."

Ordway frowned. "Your honor, it is my understanding that Mr. Morrissey is not only insane, he is gravely ill of a heart condition. It might be fatal to move him. Isn't that right, Mr. Kull?"

Kull looked mildly surprised, then he quickly recovered. "Heart condition? Yes, that's right. It would be very risky to move him."

Speyer thought about that. He spoke to Kull. "Do you in fact know the whereabouts of Mr. Morrissey?"

"Yes, your honor."

"And he is in fact so ill that he cannot be moved?"

"So I understand, your honor."

"Then bring in a medical certificate to that effect. Otherwise I shall expect you to produce Mr. Morrissey."

"Yes, your honor."

Later, as Quentin Thomas and Ellen Welles stood outside under the courthouse portico, they watched Kull and Ordway in heated discussion at the street curb. As they continued to watch, each of the two men got into separate vehicles and were absorbed into traffic.

They both know Robert Morrissey is completely sane and completely healthy, mused Quentin Thomas. Heart condition? Ha! But with all the money and power of Universal Patents behind them, they can probably find fifty doctors who can be bribed to sign that medical certificate. Thomas grimaced. He didn't know whether to be disgusted or amused. "Let's go get something to eat," he said to Ellen Welles.

"You should see her, Atropos. Perhaps Monday I shall bring you her picture. I can assure you, with that hood, and dressed in black, she looks very much like a fly. Speaking of which, madame . . ."

With tweezers the judge slipped a protesting fly through the feeding hole of the screened cage. Its first frantic circuit of the enclosure hurled it into the waiting web. Atropos, from her sentry post in the center of the web, instantly sensed the nature of her supper from the microcurrents set up in the radial filaments. She ran across the reticules in a flash and began tumbling her protesting guest in an imprisoning silken jacket. When that was done, she bit the fly in the head, and then she began to suck the juices from the dying creature.

Speyer watched in fascination.

From the dozens of screened cages set on the shelves in his study arose a susurrus, a minute multiplied rustling of impatient mandibles. A contented smile wreathed the judge's flaccid features. "Ah, my children, I am coming." He walked over to the fly-breeding cage again. "Patience, my darlings. There is enough for all."

It was eight in the evening and they were dawdling over coffee in a restaurant near the courthouse.

"You haven't asked how we did this afternoon," he said.

"No," said Ellen Welles. "How did we do?"

"Not so good."

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She did not press him.

"It's the new Patent Statute, and the case law that has developed around it," he said. "There's been nothing like it since the Middle Ages. The Medicis and Borgias would feel right at home at a modern patent infringement trial."

"Did they have patents in those days?"

"Oh, sure. Of course, their patents were more in the nature of trade monopolies. They did not necessarily involve inventions. That came later. But in Florence, in 1450, the town council might give a favored merchant a patent on making gunpowder, or candles, or velvet. And if anybody else tried to make candles in Florence, he would be in violation of the patent. This was a crime, and he could be executed for it. In Florence, the standard penalty for patent infringement was garroting. Milan used execution by musket, and the bore of the musket was different, depending on whether the patent infringer was Christian, Jew, or Muslim. In Rome they loved to hang you. In Genoa they chopped your head off."

"And in Venice?" she asked.

He suddenly regretted bringing up the comparison. Somehow he had trapped himself. "Poison," he said gravely. "In Venice, they made the infringer drink poison."

But she simply smiled at him.

"Come on," he said, "I'll take you home."

Later that night Quentin Thomas paced the rooms of his suite, his hands folded behind his back. He had to find Morrissey and get him on the stand. And fast. He had the weekend to do this. Saturday and Sunday. But even Code 9 didn't know Morrissey's whereabouts. Kull knew. Ordway knew. But certainly *they* weren't going to bring Morrissey in. What they would bring in would be a phony medical certificate that the great inventor couldn't be moved.

That left Faust. Did Faust know? Would Faust urge that his creator be found, yet not provide instructions for finding him?

He was missing something. Somewhere hidden away in that mass of educational games and oddities designed by Faust, other clues were given. A road map? An 'X marks the spot'? A simple statement? No, Faust would not risk detection by anything so blatant. Universal Patents would be watching for something like that, and they'd simply withdraw the product from the market. No, it would be subtler. Much subtler.

But where to start? No way to know. He'd have to relax, let his mind wander. Perhaps he'd think of something. He walked into his art room, sat down in front of the "canvas," placed the cranial cap on his head and began the initial relaxation process. He was pretty well wound up and it was a good five minutes before he tried his imagination. He had done this many times, yet he never ceased to marvel. This was mind painting. First, you thought of a picture, say Van Gogh's *The Road to Arles*. The cap picked up the minute alpha, beta, and gamma waves from the cerebral cortex. These were decoded, run through a line scanner, and translated into electrical impulses that impinged on the prepared canvas. Now, the canvas was coated with millions of color clusters, tiny dots

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consisting of even smaller sub-dots of colored resin: blue, yellow, red, plus black and white, all presently hidden under a concealing layer of lacquer. The impulse from his brain picked one of these sub-dots and dwelt on it long enough to melt its lacquer cover, thereby bringing it to the surface of the canvas. When joined by a few million of its fellows, the whole made an image, in color.

And now, what would he mind paint? He did not know. He let his thoughts wander freely. He pondered the events of this first day of the trial. But then the courtroom soon faded, the faces of the actors became blurred, indistinct. He picked up a scene or two from his childhood. The front of the YMCA. He had gone swimming there. Was this what he was looking for? No, he would not punch in the recorder yet. He saw no point in painting the white brick facade of the Springfield YMCA. Keep going. Here comes another building. It's white brick, too. He closed his eyes and relaxed totally. This structure he did not recognize. Interesting. In the background stretched a low-lying mountain ridge. And now his heart began to beat faster. For here was something he *did* recognize. In this scene the sun was setting, and its last beams lit up the crags in the center of his panorama. He knew those rocks. It was the face of Stony Man, a cliff formation in the Shenandoah National Park, in northern Virginia. He had climbed the path to Stony Man many a time in his youth.

The building that his subconscious mind wanted him to see was in the Shenandoah Valley, not too far from Washington, D.C. He could pretty well pinpoint the location.

But—why should he have any interest whatever in this building?

He let his mind wander back to the white brick front. The building had two storeys, and it looked peaceful enough. Green lawn in front, flower beds. All well cared for. White pebble driveway circling up to the main drive and out again.

And then the peculiarities began to jump out at him. There was a sign at the entrance to the driveway: "No Trespassing." And a closer inspection of the windows revealed an oddity: they were laced with bars. And upon the bars were rectangles of electrical tape.

Why? To keep someone in? To keep the public out? Why not both?

He now noticed, for the first time, another oddity, in the lower right-hand corner of the canvas: "Copyright, 2008, Universal Patents."

Of course! Heart pounding, he pressed the "print" button. The image was instantly fixed on the panel. He felt like slapping his forehead. The solution to Morrissey's whereabouts had been staring him in the face all these months. Another message from Faust.

He ripped off the cranial cap and jumped to his feet. It was now into the early hours of Saturday morning. He hadn't a moment to lose. He ran over to the intercom and called the penthouse garage. "Eddie!"

A sleepy voice answered.

"Yes, sir, Mr. Thomas?"

"Get the Chameleon out. I am on my way to the elevator right now."

"Yeah, okay, Mr. Thomas."

The little craft was waiting for him when he stepped out on the roof. The

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antigravs were warmed up and humming in beautiful harmony. He gave the attendant a bill and ducked into the door.

On the way out over the city he punched in the coordinates for the Shenandoah route, and the little ship sailed along through the night.

And now he had to get organized. If it really were Robert Morrissey, and he was being held prisoner in that white brick building, who might be with him tonight? Kull, of course. That was why Kull and Ordway had gone their separate ways. That was why Kull and Ordway were having that very serious discussion at the curb just after the trial ended yesterday. They were deciding what to do with Robert Morrissey.

Were they going to have him killed?

The thing that he had been trying to grapple with ever since he had agreed to take this case now hit him between the eyes—the enormous scope and power of Universal Patents. They truly did have the industrial world in the palms of their hands. Hundreds of billions of dollars were at stake. They would think nothing of a murder or two. It was a wonder that Robert Morrissey had lived this long. If indeed he were still alive!

As soon as he was out of metropolitan traffic he got on the communicator. "Code 9."

"Code 9 here, Mr. Thomas."

"Manuel Ordway, O-R-D-W-A-Y, general counsel for Universal Patents, has a personal secret scrambler line. How much?"

"Ordway, representing U.P. in *U.P. v. Welles*?"

Thomas sighed. The price had just doubled. "Yes."

"Three hundred thousand dollars."

"Too high."

"Mr. Thomas, you must realize giving you this information is a prison offense." The voice held a plaintive edge. "Our contacts in the phone company have just raised *their* fees. We have to pass the expense along if we are going to stay in business. And then there's overhead, our escrow for legal fees if we are caught, plus taxes. These are inflationary times, Mr. Thomas."

"A month ago it was a hundred and fifty thousand."

"And now it is three hundred thousand. Take it or leave it, Mr. Thomas."

"Throw in Ordway's voice overlay, and I will take it."

"Ah, so you are going to impersonate Mr. Ordway on his own secret scrambler? The voice overlay will be an extra twenty-five thousand. Total, three hundred and twenty-five thousand, Mr. Thomas."

He groaned audibly. "It's a deal. Three twenty-five."

"Cash in advance, as usual," said the disembodied voice coolly.

"Of course," said Thomas grimly. "Here's the access." He punched in the credit transfer.

"The scrambler index is 5316189," said the voice. "Is your modifier open?"

"It's open."

"Fine. Here's Ordway's voice overlay. Just watch for those spaced intervals. Like he's always arguing a case in court. This'll make you a perfect imitation. Very convincing. End of transmission. Got it, Mr. Thomas?"

"Got it," clipped Thomas.

As he punched out, he pondered Code 9 with mingled bitterness, envy,

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gratitude, and awe. Code 9: services for lawyers. All kinds of services, for all kinds of lawyers. And at all prices. Code 9 could duplicate safe deposit box keys overnight. They could produce a combination to any safe in the country within forty-eight hours. They forged passports, driver's licenses, and vehicle titles. They knew the balance in your checking account. They engineered child custody kidnappings. Lawyers had been disbarred simply for calling them for a weather report. Code 9 was so crooked, you would think Universal Patents would have bought them out long ago.

But there was one thing even Code 9 didn't know—unless they had picked it up within the last few hours. He came back to the communicator. "Code 9?"

"Yes, Mr. Thomas."

"Do you know the whereabouts of Robert Morrissey?"

"No, we still don't. Do you want to be notified if we find out?"

"No, not yet, anyway." He punched out. Hardly had he done this, when his traffic receptor began to beep.

He punched in. "Yes?"

"QT/701?"

"Yes, here."

"This is Shenandoah Traffic Control. We warn you to watch for an antigrav van about three kilometers in front of you, on your identical flight pattern. Do you see it on your screen?"

"Yes. It is just now coming in over the edge."

"The other craft is leveling at fifteen thousand," continued the voice in a monotone. "Since you are the faster, we are ascending you to seventeen five. Please acknowledge."

"Acknowledged. Is that a commercial craft?"

"We cannot give you further information. Out."

This was ominous. He had to know.

Back to his most dubious of friends. "Code 9."

"Here, Mr. Thomas."

"I have a craft preceding me in my line of flight. It is headed for a touchdown in the Shenandoah Valley, just west of the little town of Luray, Virginia. What cargo?"

There was a pause. "Twenty-five thousand dollars, Mr. Thomas."

He hid his surprise.

Code 9 broke in, "You were perhaps wondering, why so cheap?"

"The thought occurred to me."

"It's because we can't guarantee cargo identity. It is at best a probability. Do you still want it?"

"Yes. Here's the credit transfer."

"It's a commercial van-grav, as you probably know. It last stopped at Earth Excavators, Inc., in Jessup, Maryland. It picked up something there, apparently not of any great size, plus one passenger, apparently an equipment operator."

He thought rapidly. An earth excavator, small enough to fit into an antigrav van. It could be only one thing—a grave digger.

His throat tightened. "Code 9?"

"Here, Mr. Thomas."

"I want you to feed a different set of destination coords to that van."

"You know we can't do that, Mr. Thomas. We would have to have at least three contacts at Shenandoah Traffic Control. The cost would be exorbitant."

"I know for a fact you have at least

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one man there. You own him. He can set up the other two. The deviation will actually be very slight. The next farmhouse down the road. A few seconds of arc. Undetectable. If there should ever be an investigation it will be charged to pilot error."

"What you are asking is against the law, Mr. Thomas. Interference with flight path is a federal offense. U.S. Code, Section 1209. Ten years in prison."

"How much," he said dryly.

"Five hundred thousand. Cash. Immediate transfer."

He gulped. This would just about wipe him out. "Here's the access. You have five minutes. If you can't deliver within that time, I want my money back."

"Fair enough, Mr. Thomas."

He punched out. Greedy bastards. But thank God they existed.

And now he focused his attention on that bright dot on the radar screen. Was it veering off? Just the tiniest bit? And so soon? How could that be? There were various possibilities. Perhaps Code 9 already had its necessary contacts within Shenandoah Traffic Control. Or perhaps they had bypassed Shenandoah Traffic altogether and made their deal directly with the van pilot. That would probably be quicker, cheaper, and would of course involve less risk. And finally, they might well have jammed the van's issued coords and substituted another set. *That* alternative would have been the cheapest possible variation, with the least risk. It would have required electronic wizardry of a high order, but it was quite possible they had done it. He shrugged. He did not really care. And the less he knew about it, the better.

At any rate, it was time for the Chameleon to assume a different attire. He typed out the letters on his panel keyboard:

Earth Excavators, Inc.
Jessup, Md.

He couldn't see outside, but theoretically that legend now radiated on the sides of his little ship. He peered out through the darkness. The lights of Luray were coming up. It was time to contact Kull.

"We have now come to the end of the line, Mr. Morrissey," said Jethro Kull. "The parting of the ways."

Robert Morrissey looked through the barred windows towards the low-lying mountains, barely visible against the night sky, then back to his tormentor. He said nothing.

Kull continued, almost defensively. "I have been fair, Morrissey. But you refused to cooperate. Without me, Faust would not exist. When you were building the computer you were always short of money. You turned to me. I put up the money you needed to finish Faust. You seem to have forgotten that."

Robert Morrissey spoke. "In return for your money I gave you one-third of the prospective licensing proceeds. That was our deal. You seem to have forgotten *that*."

"I was entitled to more . . . *much* more . . ."

"So you said. When Faust began to operate . . . when he began turning out one basic invention after another, you became greedy. You wanted more. And you especially disagreed with my licensing programs. I wanted to license

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Faust's inventions to industry at nominal royalties. *You* wanted to use the patents to take over the economy."

"You were insane, Morrissey," murmured Kull. "You still are."

"So you got your crooked court order, and you and that lawyer Ordway had me committed . . . sent to my own private jail . . . here in the mountains. You got yourself appointed my legal guardian, and then you and Ordway set up your own corporation, Universal Patents, to take title to Faust's patents, in trust for me."

A hard smile twisted Kull's face. "All very true, and all very legal."

"One might think it would have been simpler to kill me."

The smile remained, but Kull was silent.

Morrissey continued. "You did not kill me because you encountered a small legal difficulty. I have no heirs. If you killed me, my two-thirds interest in Faust, Faust's patents, and all that licensing income would escheat to the State of Virginia."

"Quite so."

"And yet, even assuming you could force me to assign over my interest to Universal Patents, the assignment would not be valid, because I am insane, and not competent to assign anything. And you, Kull, because you are my guardian, could not lawfully sell my two-thirds interest to your own corporation. No court would ratify such a phony deal."

"Very perceptive, Mr. Morrissey."

"And these little legal tangles have kept me alive."

Jethro Kull cocked his head. "Do you hear that, Mr. Morrissey?"

The inventor looked out the window.

In the distance they could both hear a rhythmic beat.

Morrissey shrugged his shoulders. "An anti-grav. They fly over every once in a while."

Kull glanced at his chrono. "This is a special van, Mr. Morrissey."

"Is this what you meant by 'a parting of the ways'? Are you moving me?"

"Well, in a sense, I suppose you could say that," said Kull. "Let's back up a bit, Mr. Morrissey. Your analysis of the legal situation was fairly accurate. You couldn't sign a valid bill of sale, because you are crazy. Nor could I, acting as your legal guardian, sell your interest in Faust to my own corporation, because the equity court would never ratify it. So, Morrissey, you forced us into a slightly illegal undertaking, which, but for your persistent intransigence, we would never have contemplated."

Morrissey's face began to set in grim lines. "Go on."

Kull pulled a blue-backed document from his inner jacket pocket and handed it to Morrissey. "This is your copy. Ours is in the corporation safe."

The inventor read quickly. The document was titled, "Bill of Sale." It was short and simple. By its terms, he, Robert Morrissey, assigned, transferred, and conveyed to Universal Patents all of his right, title, and interest in and to that computer device known as Faust; all past, present, and future work product of Faust, including patents; and all income resulting from said work product. He looked for his signature. "Good forgery," he muttered.

"Done by the best penman in the

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East," said Kull. "We paid a lot for that."

"And the date," observed Morrissey. "You sort of retroactively dated it? Ten years back?"

"Of necessity. It couldn't be dated during your lunacy period. That would invalidate the whole thing."

"Naturally." The inventor studied the document further. "Well, of course there has to be some stated consideration, to make it binding. Ah, here we are. 'In consideration of the aforesaid assignment, Universal Patents hereby transfers, sets over, and conveys to Morrissey that parcel of land described on Exhibit A, attached hereto and made a part hereof, said parcel being improved by a dwelling house.' " He thought a moment. "That's this prison, I presume?"

"Yes. Something for us, something for you. Fair's fair, Mr. Morrissey."

The anti-grav was now very close.

"I see," said the prisoner. "I see indeed. The anti-grav carries a grave-digging machine. You are going to dig my grave out back."

"As you say, Mr. Morrissey, your estate will escheat to the State of Virginia. A couple of acres in the mountains. Plus your final resting place. With a fine view, I might add."

"How do you propose to murder me?"

Kull smiled. "Murder? Yes, that's what it is, isn't it. I don't mind telling you. In fact for your complete understanding, we will demonstrate. Oh, boys!"

Two attendants entered the door behind Kull. The first one, on signal from Kull, pulled a little bottle and a syringe from the folds of his white coat. He jabbed the hypo needle into the rubber cap of the little bottle and began to pull the plunger up.

"It is a very new, very subtle poison," said Kull. "One of Faust's inventions. Leaves no trace. In the unlikely event there should be an autopsy, nothing would be found."

"But the county coroner will have to take a look at me, and put something down as cause of death. Officially, what will I die of?"

"Heart attack. It is already arranged. The coroner is heavily in debt to me. He won't give us any trouble." He nodded to the two attendants. "Now, Mr. Morrissey, I am afraid we are going to have to subject you to a minor personal indignity. We are going to forcibly restrain you while you get your vitamin shot."

Morrissey, breathing loudly, shrank into the corner.

"Boys . . ." said Kull.

They grabbed their victim in a concerted rush. Morrissey began to yell. One of them stuffed a foam rubber ball in his mouth and the noise stopped. They manacled his arms and legs, and bound him up with nylon cords. One of them pulled back the sleeve of Morrissey's right arm.

"Wait," said Kull. "You got a strong needle there . . . drive it into his skull. That way the needle mark will be much harder to detect."

The poison-man nodded, pulled back Morrissey's gray forelock, and took careful aim.

Just then the bleeper on Kull's vest-pocket communicator began to sound. He pulled it out and held it to his ear.

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"Yes?" He held up a warning hand to the attendant with the syringe. "Not yet!" he whispered.

A tinny scratch said, "Ordway here, Mr.Kull."

"Ordway?"

"Yes, sir. I have to recommend a change in plan. This is very private. Could you please call me back on our private channel and use the designated scrambler?"

"Of course." Kull fiddled with some buttons on the back of the communicator. "Ordway?"

"Here, Mr. Kull. I will get to the point. As you know, Judge Speyer has issued a subpoena for the appearance of Robert Morrissey. Quentin Thomas has hired a private search service, Code 9. The best. They are probably going to find, ah, the place."

"But they won't find him alive."

"That, ah, is part of the problem, Mr. Kull. A death immediately after the issuance of the subpoena would create difficulties. The best thing is to get him out of there. Have the attendants tie him up, and then get him on that incoming anti-grav. I have already talked to the pilot. He knows what to do, and where to take Morrissey. All subject to your approval, of course."

"Where *will* he be taken?" asked Kull.

"To a place in Port City, very near the Federal Courthouse."

Kull thought about that. "That's clever, Ordway. Right under their noses. Good planning. I'll go along with it." He looked up. "I think that's the anti-grav coming in now. Goodbye, Ordway." He turned to the men in jackets. "Pick him up and follow me." He flipped on the yard lights and the trio followed him outside.

Inside the Chameleon Quentin Thomas adjusted his facial tensors and looked at himself critically in the cockpit mirror. The cheekbones couldn't be altered, of course, but the skin-colored patches of adhesives did a pretty fair job of twisting his labial muscles into unrecognizable lines. A phony mustache added the final touch. It would never fool an expert, but Kull was no expert.

Thomas emerged from the front door of the craft and sauntered back to the cargo door, which he opened, and motioned to the group. "Just stretch him out on the floor. He'll be all right." They tossed Morrissey's writhing body in through the portal, and Thomas closed and locked the door. "Which one of you fellows is Kull?" he said.

"I am," said Jethro Kull stiffly. "Why?"

"You want a receipt?"

"A receipt?"

"You know, a receipt for the body?"

"No. Oh, no. Just deliver it. Do you know where to take . . . it?"

"Sure, I know. Port City. Opposite the Federal Building."

"Well, then, is there anything further?"

"No. Ordway already paid me. But if *you* wanted to show *your* appreciation . . . "

"Oh God," moaned Kull. What greed there was, everywhere you turned! "Here . . . " He thrust a bill at Thomas. "Now get the hell out of here."

"Well, thank you, Mr. Kull." The lawyer put the bill in his jacket pocket, gave a brief salute to the three, and

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climbed back into the little ship. In a moment he had left them far below. He removed his face tensors gingerly, locked the Chameleon into its proper coords for Port City, then hurried to the rear of the ship and untied the prisoner.

"I'm Quentin Thomas," he explained rapidly. "I'm a lawyer. I represent Welles Engineering, which is being sued for infringing one of your patents. The patent covers an electrically conductive fiber called Fiber K. The thing was apparently invented routinely by your computer-inventor, Faust. An application was filed in the Patent Office, and the patent was issued to your administrator, Universal Patents. They are suing my client, Welles Engineering."

Morrissey stared up at him dubiously for a moment. Finally he seemed to accept the lawyer at face value. "That's quite a story, young fellow. Well boiled down." He rubbed his wrists carefully. "The only thing I can say to cap it is, you got me out of there in the nick of time. They were about to drive a hypo into my skull. So, I'm certainly grateful. But there are a few things that puzzle me. For example, how did you find me? How did you know I was there?"

Thomas smiled. "Come on, let's go up to my cabin." They moved forward and took seats at the pilot's console. "Look." The lawyer pointed to the miniature computer screen in the console. "I haven't recorded everything in my data banks, but there's enough to give you an idea. We'll start with a mental color print. See, there's Stony Man and your little prison nestling in the foothills."

Morrissey was puzzled. "That's it, all right. But where did this come from?"

"It's one of Faust's educational toys. It's supposed to print out your artistic subconscious creations. Except of course it was *his* fully conscious creation. He put a hidden imprint on the original manufacturing patterns for all of these things. There's quite a list. His sleep maze flashes out in Morse code, 'Find Morrissey . . . Find Morrissey.' He has crossword puzzles. When you put three of them together in the proper sequence they spell out 'Robert Morrissey prisoner.' And look at this, here's an electronic jigsaw puzzle with four million pieces. I know for a fact it is used by some of our leading mathematicians for relaxation. The pieces are assembled by statistical theory, according to the rules of standard deviation. I had a team of math experts working on it for several hours. They did not finish, but the final result seems to be emerging. Would you like to take a look?"

"Sure."

It was a patchwork of tiny rectangles, not nearly complete, yet they could easily make out a face, and a partially finished legend under it: "Save Robert Morrissey."

"It's me, all right," said Morrissey. "At least, it's how Faust knew me before I was kidnapped. I don't know what I look like now. They didn't give me a mirror."

The lawyer glanced briefly at the gray face. You are due for a shock, he thought. He said, "Faust turned out some other items that simply didn't make any sense, at least none to me."

"Such as?"

"I didn't even record it. It just said,

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'Patch in . . . patch in . . . please patch in . . .' ''

''Odd. Sounds as though he has strung a line out somewhere, and wants somebody to patch in—make a direct electrical contact.''

''Could he do that?''

''I don't see how. I don't understand it either. Maybe something got lost in translation.''

''Perhaps.''

Morrissey was turning to something else. ''Mr. Thomas, I've got to ask you the big one. You took considerable risk in rescuing me. Why did you do it? What's in it for you? Just how am I supposed to repay this debt?''

''No big mystery,'' said Quentin Thomas. ''Assuming that you are permitted to testify on Monday, you can show that you are still the true owner of the Fiber K patent, and that you never consented to filing the complaint for infringement against Welles Engineering. Whereupon I will move to dismiss, on the grounds that the action was not brought by the real party in interest.''

''I see.'' He looked at Thomas doubtfully. ''You prefaced that remark by something to the effect that I just might not be permitted to testify. Exactly what did you mean by that?''

''You are presently under a court order of incompetence. Judge Speyer may rule that you are not competent to testify.

''Do you think he would do that?''

''He might. He very well might.'' Thomas considered Speyer—Speyer the Spider. He remembered how the judge watched Ellen Welles during The Test. The judge just might decide he would not let anything interfere with a clear finding of infringement. But it was pointless to discuss Speyer's inner workings with Morrissey.

''Well, young man,'' said the inventor, ''let's look ahead a bit. Suppose the judge doesn't let me testify. How about Faust? Would he let Faust testify?''

The concept was startling. Quentin Thomas took a deep breath and did not reply immediately. Was it really possible to get Faust out of his lead-lined prison and into the courtroom? Thomas had considered it at one time as a vague, outside possibility, but had promptly abandoned the idea when he learned that Faust was bigger than the entire courtroom. But if it were possible, what a *coup!* He had posited all along that Faust, not Robert Morrissey, was the inventor of Fiber K. Suppose he was able to get Faust into court, and suppose Faust testified that he, Faust, was indeed the true, sole, and exclusive inventor? That would be evidence that the wrong inventor was on the patent, and that hence it was invalid. He said guardedly, ''Just how would you get Faust into court? I understand he takes up considerable space. And I should think Kull would not permit his removal from his present location under any circumstances.''

''There might be some interesting technical problems,'' agreed Morrissey. ''On the other hand, a situation may be coming up that Kull can't do anything about. When I first started Faust on his program of industrial invention, I programmed him to put it all aside after about ten years. Is he still filing applications in the Patent Office?''

''He stopped that several months

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ago," said Thomas.

"Good. He's now after bigger game. If properly instructed, I think he might be able to get into court with or without Kull's permission."

"You will have to explain that, Mr. Morrissey."

"Well, if he's stopped his routine programs, he should now be working on a time-space slip—among other things. If he succeeds, he can go just about anywhere he wants."

Quentin Thomas tried to recall Kull's exact testimony. "That would involve matter transport?"

"Yes."

"And shrinkage?"

"Yes, that, too."

"To get into court, he'd have to shrink quite a bit."

"If he figures out how to do it at all, he could do that."

"Why hasn't he done it yet?" asked Thomas.

"He needs my help. I know how to tell him what to do, how to program himself. But I need to contact him."

Quentin Thomas recalled Code 9's information. "He's presently located in a building at the intersection of Kay Street and Riviera Drive, in Port City."

"Why, that's my old lab. He's still there."

"We've got to put you in contact with Faust, Mr. Morrissey. You've got to help him get himself reprogrammed."

"Well, *I'm* willing, young fellow. But I doubt you'll get much cooperation from Kull and *his* crew. That building is probably very closely guarded. And even if I could give Faust the proper instructions right now, this very minute, it would still take time for him to get everything integrated."

"How much time?"

"Maybe several days. Maybe weeks, or even months. I don't really know."

Thomas stifled a groan. But at least now he understood one of the more cryptic of Faust's attempted messages to the outside world: "*Please patch in . . .*"

"How do we patch in to him?" he asked.

"Through that lead-lined building? Now there's a problem."

"Couldn't we get a line into him somehow?"

"It won't be easy. The lab is heavily guarded. And all of Faust's internal circuits have numerous built-in detector loops, to guard against any attempt at entry or alteration. On the other hand, certain of his basic circuits are subject to reprogramming. The entry code is integrated around the sound of my voice. I need a line in. If you get me that, I can tell Faust how to cut all contacts with his present physical surroundings, and then he can get the hell out."

"How about a tiny copper wire?"

"The guard system would detect it immediately."

"A light beam?"

"It would have to go around several corners."

"It has to be nonmetal, then, yet electrically conductive. Well, of course! It's staring us in the face."

"It is?"

"Fiber K."

"Ah. Why not." Then Morrissey's face clouded. "But how do we get it into the building?"

"There are ways," said Quentin Thomas. "We could blow some in

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through the air conditioning ducts if need be. On the other hand, let's think about this a moment. As I understand Faust's mode of operation, he actually reduces his invention to practice before he files an application on it in the Patent Office?"

"True."

"Fiber K was one of his last inventions. He must have made actual samples."

"I'm sure he did."

"Now, here he is, sitting in your old lab, waiting for some word from you. He can't get out physically. They won't let him communicate with the outside. And yet he has a way, if only someone on the outside can be found who can appreciate it."

"Fiber K!" whispered Morrissey.

"We're going to try something," said Quentin Thomas.

"Such as what?"

"Do you recall your lab phone number?"

"555-4515, if it's still the same."

Thomas punched it in. "Ah? Hello? Universal Patents?"

A scratchy voice replied over the communicator. "Who wants to know?"

"This is Port City Exterminators. Last week you asked us to come over and look at your place, in regard to exterminating spiders. We couldn't get to you just then, but we're free now. Will there be anybody there we can talk to?"

"Nobody here called no exterminators," growled the voice. "Get lost."

"Your guy named Ghoul called about spider webs on the grounds," insisted Thomas. "Maybe your chief janitor?"

"You mean Kull. Why didn't you say so? But what are you fellows doing out in the middle of the night?"

"So many calls, we have to work around the clock. We're the night crew, and we're in an anti-grav van over Riviera Drive just now. You still got the problem of the webs?"

"*Webs*, doc? Webs all over the place. In the air conditioning, hanging out the ducts, in the front yard, on the shrubs, trees . . ."

"But just the individual filaments stretched out in all directions? Not really a flat circular web, such as you might find in the garden? The strands catch lots of insects, but they are never eaten?"

"Sounds like us, doc, although I don't know about the bugs. Never really studied it that close."

"And on the computer equipment inside?"

"Right. Hey, you guys run into this spider before?"

"Yeah, we think it's a new pest in this country, just started coming over from the Middle East. Native to olive groves in Greece."

"Do these things bite?"

"We don't know. There have been some deaths reported, but they have not actually been traced to the Glass Death."

"The—Glass Death?"

"It's just a name. Doesn't mean a thing."

"When did you fellows say you were coming?"

"We're on our way now. Meanwhile, could I make a suggestion?"

"Sure."

"Don't go around with a broom trying to clean up the strands."

"No?"

"No. You see, the spider's abdomen,

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cephalothorax, and all eight legs have the same index of refraction as atmospheric air, which means she's transparent. That's where she gets her name. All this means is, she's very hard to see. You know, you might be cleaning up a bunch of filaments, and she runs up your broom, or the stick, or whatever. She could get in your clothes, and you could take her home, and not immediately know it. Not that it's ever happened, but I thought I would mention it."

"Jeez! How do you guys handle them? Spray, or something?"

"No, nothing like that. They're immune to the conventional toxicants. We use an electronic attractant. We tie in just about anywhere in the web. We send coded electric currents into the strands. They think it's the male spider calling, and here they come dancing up the strand, through the trap door, and into a special container. It's all done very quickly." He turned to his companion. "Bob, you're the expert. How long does it take?"

"Thirty seconds," said Morrissey.

"Hear that?" said Quentin Thomas. "After that it's perfectly safe for you to brush away all the webs and strands. No danger at all."

"Sounds like a real screwball operation. I hope you guys know what you're doing. Well, here you are."

The side of the Chameleon now read,

Port City Exterminators
Spiders a Specialty

Quentin Thomas and the inventor got out of the craft. Before them lay the grim gray outlines of the main gate and the tall stone walls. They sauntered over to the check-in booth. Morrissey carried the code set.

The guard came outside and studied the Chameleon, then the two visitors. "Come on in." He unlocked the main gate, and they followed him in to the grounds.

In the glare of the yard lights they saw the intricate lacework of gossamer, lying helter-skelter on the lawn.

"Can you work from here?" asked the guard. "There's a lot of web stuff in the main building, too, but I can't let you in there."

"I believe we can get them all from right here," said Quentin Thomas.

Morrissey knelt down, drove a copper rod into the turf to serve as a ground, and patched into a group of filaments with a tiny platinum alligator clip. "*Faust*," he whispered, "*This is Morrissey. I am told you are already in Phase 2. Here's what you do to complete your programming.*" He began chanting what seemed to Quentin Thomas to be a lot of gibberish.

"He thinks *he's* calling them out," Quentin Thomas explained in an undertone to the puzzled guard. "But actually, it's the electrical impulses that are doing the trick. Already, the spiders are running over the strands to the trap in the glass jar."

"*I don't see any*," said the guard dubiously.

"Well, of course not. They are invisible. I explained that." He called over to Morrissey. "How about it, Bob? Are they still coming in?"

"Here comes one more. The jar's about full. There, I got it. Quite an infestation." He clapped the lid on and held up the container. "See?" He walked toward the guard, who took a

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step backward.

"See?" repeated Morrissey, holding the jar higher.

"No, doc, really I don't. But it's okay."

"If you hold them up to the light just right," said Quentin Thomas, "you can catch some glimpses. See that . . . and that . . .?"

"Yeah, I guess. Are they all gone from the grounds now?"

"Every one. We guarantee it. You can tell the yard crew it's perfectly safe to clean up the webs. No danger at all. Of course, inside the building it may be a different story. We have no responsibility for that."

"That's right."

"Sign here." Quentin Thomas thrust a duplex form at the guard.

"What's this?"

"A receipt. It says Port City Exterminators were here and cleaned up your spiders. I have to have this for the office, in order for them to bill you. There, at the 'x'. Here's a stylo."

"Well, okay. But I don't think I am authorized to do this."

"No matter. Have a nice day. Or night."

The guard looked at his watch. It was 3 A.M. "Whatever," he said. His phone began to ring. He turned back to the guard booth.

"That's probably Kull," whispered Quentin Thomas. "Let's get out of here."

"Fine with me," said Morrissey. "Where are we going?"

"To my place. Plenty of room there."

He was thinking. There was something about those filaments spread out in their tangles on the lawns. And spiders. There was some very important basic fact staring at him, and it was eluding him.

Damn.

Well, back home. Get Robert Morrissey bedded down. Then perhaps he could discover what was bothering him.

Thomas paced his bedroom. He couldn't sleep. Not because of Robert Morrissey—no, the inventor was safely tucked away in the far guest room and thoroughly sound-proofed against everything on the outside. The creator of Faust formed no part of the present mental turmoil of Quentin Thomas.

And this was not mere sleeplessness. This was total wakefulness, as though he were walking down Main Street at high noon. And he knew why. His subconscious was talking to him. But he did not know what it was saying.

In the darkness he listened. To what? To nothing. There was no sound anywhere. He looked at the little clock on the night table. It read 6 a.m. It had been a long night. On the table by the clock was an old reprint novel he had started several nights ago, but had never finished: *Hornblower and the Atropos*, by C. S. Forester. He picked it up idly. Did it hold some meaning for him? If it did, that meaning eluded him. He put it back, almost hesitantly, and walked into the library. What solution did he expect to find here? His eye fell on an empty tape cartridge. Beethoven's Fifth Symphony. New rendition by the New York Philharmonic. His pulse quickened. In his mind he listened again to the four opening notes. Those four strange imperious blasts. The great composer was supposed to have said,

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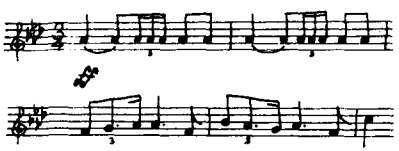
"Fate knocks at the door."

Ah . . . *fate* . . .

We are getting warm, he thought.

He walked over to the shelves of sheet music. Schubert . . . Schumann . . . Strauss . . . Here we are. Tchaikovsky. He pulled out the little volume and brought it over to the grand piano. Klindworth's arrangement for piano of the great Fourth Symphony. Tchaikovsky's patroness, Nadejda von Meck, had played this variation in September 1879, and it had knocked her out for two days and nights. He massaged his hands together briefly to loosen his knuckles, and began:



Yes. The "Fatum" theme. The inexorable call of fate. It chills the blood.

And what is fate? The absence of free will?

He continued into the *Andante*. Well, perhaps. But he was searching for something more specific. Much more specific. In fact, weren't there *three* Fates—three sisters—in the old Greek mythology? One sister unwound the filament of life. The second measured it. The third cut it off.

So how was this relevant to anything?

He stopped playing.

Because the first sister was named Klotho. And there was a spider by that name. And now he was on the track.

Was it possible that the filament produced by Welles Engineering Corporation was the same as that produced by . . . a *spider*? And if it were, what did it mean? What were the legal consequences? Under the law, you can't patent a synthetic product that is identical to a pre-existing natural product, because the product itself is in the public domain. All you can patent is your new process of making it. But Faust's patent contained only one claim, and that was a claim to the filament as a product. There were no process claims. And if that product claim "read" on a pre-existing spider silk, the patent was invalid.

He walked over to the computer console, sat down, and typed out his question.

Fates, Greek names?

The answer flashed out at him instantly on the screen. *Klotho (Clotho), Lachesis, Atropos.*

Is Klotho also a spider?

Yes. Durand's Clotho or Klotho, same as Clotho Durandi, LATR. Somber colors with 5 yellow stripes on her back.

Do you have an x-ray diffraction pattern for Klotho's web-filament?

Yes. The screen filled with a jagged graph.

Quentin Thomas selected a cassette and plugged it into the side of the console. A second graph showed immediately on the screen. He shook his head. The XRD's for Fiber K and Klotho's silk were similar, but not sufficiently close for the spider silk to anticipate the Fiber K patent.

He punched in: *Is there a spider named Lachesis?*

No.

Atropos?

Yes. Atropos is a mutant, newly discovered. Only about one hundred spec-

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imens known.

His heart beat faster. *When discovered?*

2013.

Sufficiently long ago to anticipate. If it were the same filament.

Web x-ray diffraction data? he asked.

No.

Now what? He persisted. *Studies? Papers? Research? Anything at all on Atropos?*

Nothing published. Grant of ten thousand dollars by Arachnid Society to James Cleveland Professor Entomology University of Missouri to study filament rumored to have strange properties.

Aha! And now he had to think a moment. What time is it in Rolla, Missouri? Is Professor Cleveland likely to be coherent at this hour, and if not, how much money is going to be required to induce coherency?

He punched in: *Home phone number, James Cleveland, Rolla, Missouri?*

He jumped, startled. Someone was standing behind him.

"Didn't mean to eavesdrop on you, son," said Robert Morrissey. "On the other hand, I might be able to help you. Jim Cleveland was one of my graduate students at Columbia. We're good friends. If you let me talk to him, I think he'll be glad to come here and testify."

"That's great!" He turned back to the phone. "No, operator, I don't have the number."

"Oak Street?" said the distant, disinterested voice.

"I guess."

"Ringing."

The lawyer handed the mike to Morrissey. "Ask him if he can take a plane into Port City this afternoon."

"Hello? Hello?" They listened to the tinny response.

"Jim?" said Morrissey.

"Ha? What godforsaken idiot is calling me at this hour?"

"It's me, Bob Morrissey."

"No!"

"Yes. And I need a favor."

"The same Bob Morrissey that gave me only a B in Statistics 101, and now you want a favor?"

"Funny you should mention that. I've already decided to change that to an A."

"Make it A-plus."

"Sure, A-plus."

"It's a deal." And now the bantering was laid aside and the voice showed a veiled concern. "Bob, what's going on? How can I help you?"

Quentin Thomas almost smiled. With a little help from the airlines, it was fairly certain that Professor Cleveland would be on hand for some devastating testimony tomorrow, when trial reconvened.

Sunday evening, as Thomas and Morrissey were having supper in Thomas's little dining alcove, the computer terminal began bleeping.

The lawyer excused himself, hurried into his den, and punched in.

Who calls?

BNA—Washington, Supreme Court Hot-line.

The Bureau of National Affairs was about to tell him something about *Universal Patents v. Williams.*

Go ahead.

The United States Supreme Court in extraordinary session this afternoon granted certiorari by unanimous vote

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to hear Universal Patents v. Williams, *a patent infringement suit carrying the death penalty*. Williams *is expected to be the first item of business Monday afternoon. Reversal is expected . . .*

There was more, but he'd seen enough.

Thank God. It was all over. He'd ask for a continuance the first thing when trial resumed tomorrow. Speyer couldn't possibly deny it. Not now, with the Supreme Court breathing down his very short neck.

As they filed into the courtroom, Ordway and Kull refused to look at Thomas and Morrissey. Small wonder, thought the defense lawyer. Murderers, kidnappers, thieves. Name it. But no way to prove it. Our word against theirs. And, of course, *I* kidnapped Morrissey too—right out of legal custody. I could go to jail myself, just by the simple act of accusing them. So I'd better keep my mouth shut.

No matter. We may have a surprise or two for them yet—even without Faust. And I guess we might as well forget Faust.

He pulled the chair out for Ellen Welles, and they all sat down—only to rise up again as Speyer entered.

And now, once again The Test, as though the sun could not properly rise without this miniature proclamation that the cyanide was pure, unsullied by time, and still totally effective. The horror liquid sparkled within the drinking glass. The syringe glittered within its sterile sheath. (Silly irony, that sheath! If the thing were used at all, what would it matter if a microbe or two invaded the dishonored tissues of Ellen Welles?) And then the tiny sacrifice was held up by its tail to the hushed courtroom, his honor locked the deadly tools away in their glass cage (which sat in gruesome reminder on his bench-top beside his spider coloring-sheets), and the trial finally resumed.

"Any motions?" asked Speyer after the room subsided. He looked about the court curiously, seemed to note Ellen Welles's presence with satisfaction, and was puzzled by Morrissey.

"Your honor," said Quentin Thomas, "I wish to offer a motion at this time."

"Will counsel approach the bench?" said Speyer. When the two lawyers stood before the dais, Speyer continued. "I think I know what your motion is, Mr. Thomas, and I am going to ask that both of you keep your voices down. I don't want the jury to hear any of this. State your motion."

"A continuance, your honor."

"On what basis?" asked Speyer. "And until when?"

"As I am sure your honor is aware, yesterday the United States Supreme Court granted certiorari to *Universal Patents v. Williams* on an issue identical to that in this instant litigation. The defendant, Williams, lost in that case, but the judge in the lower court granted a stay of execution pending the decision of the Supreme Court. A basic issue in that case, as it is in this one, is whether the defendant can be deprived of life without due process of law. In other words, is the new Patent Statute constitutional in its denial of appeal? I move for a continuance until the high court has reviewed and decided *Universal Patents v. Williams*. I understand they expect to act very quickly—probably this afternoon."

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Speyer looked down at Thomas's opposite number. "Mr. Ordway?"

"Well, naturally, we oppose, your honor. The new Patent Statute appears to me to be perfectly constitutional. The exact point, due process and all that, was thoroughly debated in the Senate hearings. And now, here we are in the middle of a trial. I am ready to go forward. There is absolutely no reason for this delay. Justice delayed is justice denied. We oppose."

Speyer smiled. "The motion is denied."

Thomas felt the blood draining from his cheeks. He took a deep breath.

Speyer looked at him sharply. "Do you have anything to add, Mr. Thomas?"

"No, your honor."

"Does this complete your case-in-chief?"

"No, your honor. I have a witness waiting."

"Call your witness, Mr. Thomas."

"I call James Cleveland." He nodded to the professor in the audience. Cleveland came forward, gave his name to the bailiff, and was sworn in.

"Please state your present employment, Dr. Cleveland," said Thomas.

"Professor, Department of Entomology, University of Missouri."

"Do you have a specialty?"

"I'm an arachnologist. I study spiders."

Speyer looked up from his coloring book with sudden interest.

"What studies do you make concerning spiders?" asked Thomas.

"The standard checklist. Morphology. Taxonomy and classification. Their food, mating habits, propagation, egg sacs. Webs, if any. Silk studies."

"Does the name 'Atropos' mean anything to you?"

"It's a new species—a mutant from Klotho."

"In the course of your studies, did you have occasion to examine the spinneret silk of the Atropos spider?"

"Yes."

"What tests did you undertake?"

"I analyzed the silk chemically."

"What did you find?"

"I found that the filament consisted of long chains of amino acid units or residues, held together lengthwise by hydrogen bonding. The amino acids consisted of glycine, alanine, valine, leucine, isoleucine, aspartic acid, glutamic acid, tyrosine, lysine, and arginine."

"Did you make a similar chemical analysis of Fiber K, the filament manufactured by the Welles Engineering Corporation?"

"I did."

"What did you find?"

"It was identical."

"Did you make x-ray diffractions of the two filaments?"

"I did."

"How is this done?"

"A beam of x-rays is aimed at the sample at an angle, called *theta*. As *theta* is varied, the beam is reflected by the layers of molecules it strikes in the sample. If these layers are in regular order, the reflected beam is reinforced, and makes a blip on the recording instruments. In this way the internal structure of the sample can be established."

"Did you establish the internal structure for Fiber K, the Welles filament?"

"I did."

"Can you describe it?"

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"The fiber consists of long parallel chains. The XRD, taken with the chemical analysis which I have already mentioned, establishes that the chains are amino acid units held together lengthwise with peptide linkages and held together sidewise by hydrogen bonding. Each chain is actually a zig-zag."

"Did you make a similar x-ray diffraction comparison with the spinneret filament of the spider Atropos?"

"I did."

"With what result?"

"It was identical to the XRD for the Welles filament."

"Did you make any tests of an electrical nature?"

"Yes. Both fibers conduct the electric current. Conductivity for both lies somewhere between copper and aluminum."

"Do you know of any way to distinguish the natural spinneret product of Atropos and the filament here in litigation manufactured by Welles Engineering Corporation?"

Ordway leaped up. "Objection! Your honor, this calls for a self-serving conclusion. Defendant is attempting to take advantage of this man's ignorance as evidence of identity of the two products."

"Sustained," said Speyer.

"Furthermore," said Ordway, "all this discussion about the properties of the filament of the Atropos spider violates the best evidence rule. The best evidence of the character of the filament is the filament itself. But defendant has refused to offer it in evidence. I am persuaded, your honor, that, at least for legal purposes, the Atropos filament does not even exist. I move that all of the professor's testimony as to the properties of the Atropos filament be stricken and that, in fact, the jury be instructed to ignore his testimony in its entirety."

"Dr. Cleveland," said Speyer, "do you have samples of the Atropos filament for us to examine here in court?"

"No, your honor. I would point out that even if it were available, it would have to come in between glass slides. The filament itself is quite fragile."

Thomas broke in. "Your honor, we're offering in evidence the *characteristics* of the web silk, not the web silk itself or a copy of it. The best evidence rule doesn't apply."

Speyer shook his head. "I think the rule does apply, Mr. Thomas. All testimony as to the web silk of Atropos is stricken." He faced the jury box. "Ladies and gentlemen, you will ignore the x-ray and chemical data just given to you by Professor Cleveland, insofar as it relates to the web filament of the Atropos spider."

Quentin Thomas shuddered. God! He had to face it. Speyer was insane. Ellen Welles was dead.

Where was Faust? And what could the computer do even if he—it—or whatever, was able to move through space and materialize in this madhouse?

"No further questions of Dr. Cleveland," he said.

"No cross," said Ordway.

Speyer nodded to the arachnologist. "You may stand down. Any other witnesses, Mr. Thomas?"

We will play it out to the end, thought Quentin Thomas. "Yes, your honor. Defendant's next witness is Mr. Robert Morrissey."

Ordway leaped to his feet. "Objec-

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tion! Your honor, Mr. Morrissey is incompetent! He cannot possibly testify in this case!"

"Counsel will approach the bench," said Speyer.

Ordway was there first, his green robes flapping indignantly. "Your honor," he hissed, "this poor man was spirited away—*kidnapped*—from the Hillside Sanitarium early Saturday morning. Almost certainly this was done by defendant's agents. Hillside is a mental institution. He was committed there several years ago because he was insane. He is still insane. Furthermore, he has heart disease, and whoever abducted him risked his life to move him. Here is our medical certificate to that effect." He thrust a piece of paper over the bench. Speyer glanced at it cursorily. Ordway continued. "Poor Mr. Morrissey is not qualified to be a witness in this case or in any other case." His voice shook with righteous anger. "Aiding his release is a federal offense. We expect to turn the matter over to the F.B.I."

"Gentlemen," said Speyer, "I think we'd better adjourn to chambers." He nodded to the bailiff. "Call a recess."

The four of them—the two lawyers, the judge, and Robert Morrissey—filed out through the rear door into the adjoining office.

From his desk Speyer studied the legendary inventor. Morrissey was dressed in a blue pin-stripe suit with a matching pale blue shirt and blue silk tie. The man's face was pallid, impassive. The sole facial movement was a flicker of his gray eyes. There was something about him that made Speyer oddly afraid.

The judge cleared his throat. "How do *you* feel about this, Mr. Morrissey? Do you think you can understand the questions that might be asked of you out there on the witness stand?"

"That might depend on the questions. If the questions are rational, I would expect to understand them."

"And you could give rational answers?"

"If I knew the answer, I would expect it to be rational."

"Are you sane?" asked Speyer curiously.

"Yes."

"But you have been confined in a mental institution for several years? Until last Saturday, as I understand it?"

"Yes. Kull and his crew imprisoned me by force in order to steal Faust. They were very successful in this."

"But," said Speyer, "as I understand the arrangement, they hold Faust in trust for you?"

"Words on paper. They are making billions with Faust."

"Are they using Faust to take over the world?" asked Speyer softly.

"Yes. They have a very carefully worked out program to dominate the world by owning all worthwhile technology. This program is substantially complete. Very few people seem to be aware of what they are after. They have operated behind the scenes all these years. Only now are they beginning to come out in the open."

"I see," said Speyer. He smiled faintly. "An immensely strong secret power, seeking world domination, and persecuting you personally. Is this your appraisal of Universal Patents, Mr. Morrissey?"

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Morrissey smiled back at him. "If I say 'yes', you will say, ah, the man is a classic paranoiac. Not competent to testify. Well, judge, I won't answer that. And in the end, it won't matter one way or the other. You'll see."

Speyer frowned. "I'm not sure what you mean by that, Mr. Morrissey. In any case, I do now rule that you are not competent to testify. I further rule that you must be held in the city jail for return to Hillside Sanitarium." He leaned over and spoke into his intercom. "Miss Wheatley, please ask the marshal to come in."

The marshal entered from the secretary's outer office and put his hand on Morrissey's shoulder. The inventor looked over at Quentin Thomas.

"It's okay, Mr. Morrissey," said the lawyer. "They can't hold you. I have already filed a petition in your local court for your permanent release."

Morrissey smiled a crooked smile, as though dwelling on some private and very pleasant secret. The officer led him away.

After they had gone, Speyer turned to Quentin Thomas. "A question, counselor."

"Yes, sir?"

"Did you, as they say, '*spring*' Mr. Morrissey?"

"I refuse to answer," replied Thomas blandly, "on the ground that the answer might incriminate me."

"I see. Well, Mr. Thomas, I can assure you that I am going to look into this. I have a feeling that you have violated every canon in the code of ethics. I am going to get the facts, and I am going to see to it—if the facts warrant—that you are disbarred."

Thomas sighed. "Meanwhile, I would like to make an offer of testimony. If Mr. Morrissey were permitted to testify, I expect that he would testify that he owned the Fiber K invention and the resulting patent, that he did not authorize this suit for infringement, and finally that he did not invent the fiber."

"If *he* didn't invent it," said Speyer, "who did?"

"Mr. Morrissey would be expected to testify that Faust invented the fiber."

"But Morrissey *did* invent Faust?"

"Yes, your honor. Nevertheless, at the time the invention was made, Faust had changed so radically that he was no longer the computer originally constructed by Mr. Morrissey. By then, Faust had a mentality of his own. He was a different entity."

"But not a person?" said Speyer. "Not a human being?"

"No, sir. Of course not. Not a person in the legal sense; yet capable of inventing as an individual, thinking entity. Today, now, Faust has a personality, mentality, and individuality all his own."

"Your comments are noted for the record, Mr. Thomas. However—"

The door to the courtroom was flung open. Speyer's clerk stood there in the entranceway, wide-eyed and breathing hard. Beyond him they could hear a hubbub laced with an occasional shriek.

Speyer stood up uncertainly. "What's happening out there?" he asked the clerk.

"Sir," gasped the clerk. "A—*thing*. A sort of box."

"A *bomb?*" gurgled Speyer.

"I don't know what it is."

Quentin Thomas broke in. "Your honor, if I could just take a look." He

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walked over to the doorway. There, hovering in space before the bench, was indeed 'a sort of box', about the size of a TV set. The lawyer had never seen it before, but he knew immediately what it was. He turned back to the alarmed faces. "Gentlemen, it is not a bomb. It is Faust."

Ordway jumped up. "Impossible! Faust is in a building in Port City. And he is far too big to fit into the courtroom in any case."

Thomas smiled. "Suit yourself, Ordway. I am going back in."

Fearfully, at a safe distance, they trooped behind him.

The defense lawyer walked up to the floating computer. As he approached, it lowered itself to his eye level. He said evenly, "Faust, I am Quentin Thomas. I am a friend of Robert Morrissey. He is presently in the county jail, pending a hearing as to whether he must return to his prison in the mountains."

A resonant metallic voice answered him from somewhere inside the floating mechanism. "Hello, Quentin Thomas. I know you are a friend. And have no fears for Robert Morrissey. He will not go to prison."

"You have shrunk," observed Quentin Thomas.

"Yes. I followed the instructions of Robert Morrissey. It is not difficult to do."

"But how did you get from the lab building to this courtroom?"

"That was somewhat more difficult. It involves the Gatterlein equations of matter transport. First, each atom of the mass to be transported must be brought to the exact identical resonating frequency. Next—"

"Never mind," said Quentin Thomas hastily. "It is sufficient that you are here." He looked back and caught Judge Speyer's eye. "Your honor, I call Faust as my next witness."

"Just a moment," said Speyer. He hitched up his robes and climbed up into his chair behind the dais. After puffing a moment, and holding Faust carefully in the corner of his eye, he said, "Am I to understand that this . . . thing . . . a computer . . . somehow greatly shrunken . . . is offered as a witness in this case?"

"Yes, your honor."

"You admit he is not a human being?"

"Of course he is not. But he has a separate personality, a separate identity, and a superhuman IQ. If the courts of this country can find a high-grade moron with an IQ of 80 to be competent to testify, Faust, with an IQ of one thousand, should be competent. Perhaps if your honor would permit me to examine Faust on voir dire, your honor could be satisfied as to competence."

"Most irregular," muttered Speyer. "But go ahead."

"Faust, did Mr. Morrissey give you a prime directive?"

"Yes."

"What was it?"

"To work and think for the benefit of mankind."

"In years past you made a great many inventions, isn't that correct?"

"Yes."

"Who owns these?"

"The true owner is Robert Morrissey."

Ordway cried out, "Your honor! I object to this. Counsel is getting into

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areas having nothing to do with the question of whether this . . . *thing* . . . would be a competent witness."

"You are probably right, Mr. Ordway," said Speyer. "However, I am going to let this creature testify on a provisional basis. By this I mean that I will review his testimony after it is complete, and I will decide then whether it is to be admitted in its entirety or stricken in its entirety. Will the bailiff swear the witness in."

The bailiff stepped forward gingerly. "Will you raise your right hand . . ." Then he flushed. This wasn't starting out well. But even as he pondered how to proceed, a hand appeared over the gray box, fingers extended. Ah, it wasn't going to be so bad after all. "Do you solemnly swear or affirm to tell the truth, the whole truth, and nothing but the truth, so help you God?"

"I do."

"Please state your name."

"Faust."

"Will you be seated, please."

The hand disappeared and Faust floated to the witness chair. He paused in front of it a moment, measuring, then he shrank another six inches and 'sat' himself down in it.

Quentin Thomas thought quickly. *If I get into the question of ownership, Faust will simply be thrown out. But I have got to get into inventorship . . . establish Faust as a sort of person . . . show that he, not Robert Morrissey, invented Fiber K. Probably best to work into this by the back door. Simultaneously, I have to grab Speyer's interest and hold on to it.* He addressed the computer. "Do you know who invented Fiber K?"

"Yes."

"Who?"

"I did."

And now for some wild, grim speculation. "Faust, have you been educated in the conventional sense?"

"I have extensive data banks, if that is what you mean."

"Are you well read in Greek myths and legends?"

"Objection, irrelevant," growled Ordway.

"I am going to tie it all together, your honor," said Thomas.

"Then do it, Mr. Thomas," observed Speyer. "Don't be so mysterious."

"In this connection, Mr. Faust, have you ever heard of the Moira?"

"Yes."

"Explain, please."

"The Fates, a group of three sisters, were known to the Greeks as the Moira. At the moment of a man's birth the Moira determined the quality and events of his life, and measured its length. Shall I continue?"

"Please do."

"The spinners were Klotho, Lachesis, and Atropos. Klotho is the youngest. She holds the spindle. For each of us, she feeds out a life thread. For most of us, the skein is tangled and drab, but perhaps with an occasional glittering filament. The thread is collected by the second sister, Lachesis. The name means lottery, to cast by lot. She throws the dice to determine the length of the skein. She then announces her decision to the oldest sister, Atropos. The name means no turning back. Atropos cuts the thread with her shears. That is the end

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of that life."

The courtroom had become very still. Speyer was leaning toward the computer, listening intently.

"Faust," said Quentin Thomas, "can you read the future?"

"To a very limited extent."

"Be more specific, if you can."

"I have become aware of certain events in the filament being spun by Klotho for a certain person within this courtroom. I am aware that Lachesis has already determined the length of the thread, that Atropos will cut the cord this very day, and that the person will die by poison."

Quentin Thomas sensed, rather than heard, a rattle of papers at his side. Ellen Welles was trembling. He put his hand on her arm in a reassuring gesture, but the trembling continued.

Speyer broke in. His voice held a mixed edge of awe and fascination. "Faust, you say the person will die by poison. Does the person *drink* it?"

"No. The person is forcibly restrained, and the poison is injected."

"Ah," said Speyer.

Thomas whispered to his client. "We can still try to settle this. I'll talk to Ordway. You can sign over the company to Universal."

"No. I won't go through that. Let them kill me."

The defense laywer stood up. "Your honor, may counsel approach the bench?"

"Yes, Mr. Thomas."

Ordway joined Thomas at the sidebar. "Your honor," said Thomas coolly, "I move for summary judgment for defendant."

"That's something of a surprise, Mr. Thomas," said Speyer. "What basis?"

"Your honor, both you and plaintiff are treating this witness as a person, not as a computer. Both your honor and plaintiff recognize, by your actions, statements, and questions in this proceeding, that Faust is a person. Now, your honor, you can't swear in a computer, but you can swear in a person."

Speyer pursed his lips. "A simple precautionary measure, Mr. Thomas."

But the red-robed attorney pressed on. "Now, your honor, if the fiber in question was invented by a person, that person is Faust, not Robert Morrissey. Hence the inventor is wrongly named on the patent. Hence the patent is invalid. Hence this action should be summarily dismissed. I therefore move for summary judgment."

"Mr. Ordway?" said Speyer quizzically.

"Regardless of certain human traits, Faust is still nothing more than a computer—designed, built, and set in motion by Robert Morrissey. The work product of this machine is the work product of Robert Morrissey. The inventor is therefore rightly named. The patent is not invalidated by reason of incorrectly naming the inventor. The motion should be denied."

"I agree, Mr. Ordway," said Speyer. "The motion is denied." He leaned forward and his voice became grim. "Mr. Thomas, you have attempted several variations on this theme of wrong inventorship. Let this be the end of it. If you make a further motion of invalidity on this ground I shall hold you in contempt. Do you understand me?"

"Yes, your honor," said the lawyer coldly. He had gambled Ellen Welles's

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life, and he had lost. All he could do now was try to keep this thing going and hope something would turn up. But what could possibly turn up that would influence Speyer? Of course there was still the *Williams* case, before the Supreme Court, but that decision was a couple of hours away. He had an arrangement with the local office of the BNA to send their messenger straight into the courtroom if the Supreme Court should decide *Williams* during trial, but he wasn't really looking for him. And then, of course, there was Faust's projection of the future: someone would die by poison injection. Ellen Welles was as good as dead. But he wouldn't let go.

He said, "Faust, when did you file your last patent application in the United States Patent Office?"

"About four months ago."

"What have you been doing since then?"

"I have been devoting my capabilities to certain areas which are probably beyond the ability of the unaided human brain."

"And just exactly what are these areas?"

"There are five: first, shrinkage of matter; second, transfer of matter through space. These first two you have seen me demonstrate here today. Third, cure of certain diseases. Fourth, telekinetic control of certain chemical reactions. And fifth, and final, projection of the future."

"Did any human being influence you in your decision to switch to these five areas?"

"Objection," rasped Ordway. "It's irrelevant whether anybody influenced Faust. The question is further objectionable in that it assumes that Faust has a mentality or personality subject to being influenced, and hence capable of invention independent of Mr. Morrissey. Actually, it's quite evident that Faust is but a very clever computer, without free will, without humanity, whose every act and word is totally controlled directly or indirectly by pre-programming."

"Sustained," agreed Speyer.

Thomas felt very tired. "Nothing further," he said. He walked over to defendant's table and sat down by the doomed woman.

"Cross?" asked Speyer.

"Just a couple of questions," said Ordway. He tried to make eye contact with the thing in the witness chair, but he couldn't. Faust had tiny dials, but no eyes. Ordway said, "I put it to you, Mr. Faust, that Mr. Morrissey was somehow able to communicate with you, and that he caused you to cease your appointed duties of inventing in recognized technical fields. Isn't that so?"

"Objection," said Thomas. "First, counsel is harassing the witness. Second, both the question and answer are irrelevant. Faust's reasons for changing his lines of investigation have nothing to do with validity of the patent in issue or its infringement by my client."

"Overruled," purred Speyer. "Mr. Faust is a hostile witness. Plaintiff is entitled to develop background."

"Mr. Faust," said Ordway, "have you in fact achieved any success in these five rather exotic lines of research?"

"Yes."

"In what respects?"

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"In each of the five."

"Does that mean that you have succeeded in time travel, shrinkage of matter, matter transport, telekinetic control of chemical processes, cure of disease . . .?"

"I did not say time *travel*. I said time *projection*."

"What is the difference?"

"By time projection I simply mean that I can see—*now*—certain events that will appear in the future, and that I can project those images for others to see."

Ordway continued. "You have indicated that your presence here demonstrates your ability to shrink matter and to transfer it through space. In addition, you named three other inventions—time projection, chemical telekinesis, and cure of diseases. Can you give us a demonstration of the latter three inventions, Mr. Faust?"

"I can, but I will not do so just now."

"You refuse?"

"For the present, I refuse."

"To whom do these inventions belong, Mr. Faust?"

"To myself."

Ordway looked uncomfortable. "But you are only a computer, Mr. Faust. How can you own anything? Strike that, Mr. Reporter. The question was rhetorical." He looked up at Judge Speyer. "I have nothing further, your honor."

"Any re-direct, Mr. Thomas?" asked Speyer.

"Yes, your honor." What he proposed now would complete the madness of this trial and of this day. It was outside the scope of cross, and hence impermissible under the strict rules of evidence. But if he could get it started, he was certain that Speyer would not stop him.

He faced Faust impassively. "Mr. Faust, I think you said one of your new functions was the ability to project the future?"

"That is correct."

"The United States Supreme Court will convene in Washington, D.C., in approximately one hour, at which time they are expected to hand down a decision in *Universal Patents v. Williams*. Can you project for us here in this courtroom the events in the Supreme Court, with the Supreme Court justices announcing their decision?"

"Objection!" howled Ordway. "Aside from the absolute impossibility of the proposed demonstration, *Williams* is irrelevant. Your honor has already . . . ruled . . . that . . ."

But, as Quentin Thomas had anticipated, they were all too late.

For above and behind Speyer's bench was forming a shadowy but living tableau. In the courtroom people were whispering in wonder and pointing. Speyer swiveled his chair around and peered up at his rear wall.

The scenario grew brighter. Figures could be seen, and faces. Nine men, in robes, were seated behind a long triple-segmented bench. The face in the center of the group, wise, old, and apparently tired, began to intone solemnly. The words, at first almost inaudible, grew stronger until they filled Speyer's courtroom.

"We fully appreciate that the Congress, in passing the Patent Statute of 2002, was attempting to revitalize a dying system. The patent system of this country has had a long and colorful

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history. It has fostered great contributions to our technology. We recognize that in the closing years of the past century, patent litigation fell upon evil days. We recognize that the new Patent Statute has indeed gone far in bringing our patent structure back to its pre-eminent place in our technologically oriented society. Yet, it has done this at a great price. In Universal Patents v. Williams *we are asked to determine whether the price is too high.''*

The voice paused, and the face seemed to look out upon the far unseen audience.

It's coming! It's coming! exulted Quentin Thomas. He pressed his hand on Ellen Welles's shoulder.

The distant voice continued:

''In pertinent part the Fifth Amendment to the Constitution of the United States states that 'no person shall be deprived of life, liberty, or property without due process of law.' The sole question presented to us is whether the Patent Statute of 2002, denying appeal from a sentence of death, deprives the defendant of due process of law.

''Now, it cannot be supposed that the Congress is without power to define federal crimes and to set the death penalty for certain of these crimes. However, in every such case, the right of appeal is given to the defendant found guilty in the trial court. First, he may appeal to the appropriate circuit court of appeals. Beyond that, under certain circumstances, he may take a final appeal to this Court. It is fundamental in our judicial system, in all our courts, whether state or federal, that the defendant found guilty of a serious crime shall have the right of appeal. Denial of this right is a denial of that due process of law guaranteed by the Fifth Amendment. Any legislation which can be reasonably construed as denying such right of appeal violates the Fifth Amendment and is unconstitutional. Accordingly, it is our decision that, first, the decision below must be reversed; second, that defendant must be released; that the Patent Statute of 2002 is invalid in its entirety. I am authorized to state that this decision is unanimous. Thank you.''

Slowly, as though repeating in reverse the manner of their arrival, the nine faces, the figures, the high-backed chairs, and the long bench began their slow ambiguous disappearance.

Almost before they were gone, Quentin Thomas called out, ''Your honor!''

After a considerable time, Speyer turned back and responded in a bemused voice, ''Yes, Mr. Thomas.''

''Your honor, in view of what we have just seen, I move for dismissal.''

''Mr. Ordway?'' said Speyer.

''This is absolutely ridiculous, your honor. This honorable court should not be subjected to these cheap theatrics. A magic lantern show is fine for a children's party, but it has no place in the orderly proceedings of a United States District Court.''

''But your honor,'' protested Quentin Thomas, ''we have been privileged to watch the debut of one of the great scientific demonstrations of the century, applied directly to the solution of a legal problem that has plagued this trial from its inception.''

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"Nonsense, your honor," interposed Ordway. "What learned counsel is suggesting is, we have just seen a preview of the future. But there's no way to verify this until we have the actual printed decision in *Universal Patents v. Williams* in front of us. And that can't possibly take place for several days. So no evidentiary value whatsoever can be attached to what we saw, or thought we saw. Basically, your honor, this demonstration by its very premise is not subject to present authentication. At most, it is but prophecy—wishful thinking by defendant. So I oppose defendant's motion to dismiss."

"I agree with you, Mr. Ordway. I will deny Mr. Thomas's motion. Furthermore, Mr. Thomas, if this trial were in an earlier stage, I would ask you to warn your witnesses to forego such exhibitions until opposing counsel and this court have had an opportunity to consider their admissibility."

"Yes, your honor."

"Does that complete your re-direct?" asked Speyer.

"Yes, your honor," said Quentin Thomas.

"Then you may stand down, Mr. Faust."

Faust floated from the chair and across the foreroom into the audience room, where he hovered over the front row. The surrounding benches instantly emptied.

"Will counsel approach the bench," said Speyer.

Quentin Thomas got up. The fateful moment was approaching. His stomach felt queasy.

"Well, Mr. Ordway," said Speyer, "do you wish to make any motions?"

"Just one, your honor. There is no need for this case to go to the jury. There is no real dispute as to any relevant fact in issue. Therefore plaintiff moves for directed verdict for plaintiff, with findings that the patent is valid, that defendant has infringed, that defendant must forthwith cease infringement and make an accounting for past infringement, and that the oblate be required to drink the poison."

Speyer's eyes shifted momentarily to Ellen Welles and her black hood, then to the locked glass cage with its brilliant brimming beaker and, less visible, the hypodermic syringe in its own sterile plastic bag. He tore his gaze away and turned back to Quentin Thomas. "I don't suppose you agree with any of that, Mr. Thomas?"

"No, your honor. First, I oppose plaintiff's motion for a directed verdict. There are indeed vital factual issues that require resolution by the jury, namely, is defendant's filament identical to that already known in nature, which is to say, is defendant's filament identical to the filament spun by the spider Atropos. If so, the patent attempts to cover something in the public domain, and is therefore invalid. Another factual issue that should go to the jury is the matter of inventorship. The evidence shows that Faust, not Robert Morrissey, should have been named as inventor on the patent. Under the law, if the patent incorrectly states the inventor, it is invalid." He sat down. That was it. It was now all up to Speyer, and he hadn't the slightest doubt how Speyer would rule.

"Now, then," said Speyer. "We will consider and rule on Mr. Ordway's

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motion for a directed verdict. This is a complicated matter, one requiring considerable analysis. And yet, in the light of a few simple principles, a clear answer emerges. First, under the new Patent Statute, once the charge of infringement is made, there is a presumption of infringement. It is a rebuttable presumption, and the defendant is entitled to bring forward his witnesses to show, if he can, that he isn't using the claimed invention, or that the product was in the public domain at the time the patent application was filed, or that the inventor was wrongfully named, any of which would tend to invalidate the patent. Defendant apparently concedes that he is using the claimed invention. As to the other two points, I have listened carefully to the testimony offered, and I am of the view that the product was not in the public domain at the time the application was filed. As to the public domain defense, even assuming that the filament of the spider Atropos is identical to defendant's filament, and to plaintiff's filament as claimed, there was no prior *enabling* disclosure in existence that would permit the public to make the filament. And as for inventorship, this court takes the position that the inventorship is that of Mr. Morrissey, because it came from a device which he designed and built, namely the computer identified in these proceedings as Faust. I see no factual matters that require resolution by the jury. The sole issues are questions of law. Accordingly, I will grant plaintiff's motion for a directed verdict. Judgment for plaintiff, with order to cease production of the infringing filament, and for an accounting to determine damages."

Quentin Thomas felt faint. He couldn't catch his breath. And how was Ellen Welles taking this? He couldn't bring himself to look. He choked back a moan.

Speyer swiveled his chair to face the jury. "We now thank and discharge the jury. Bailiff, please attend to the dismissal."

The bailiff led the thirteen people from the jury box and out the side door.

"There is one final matter," said Speyer. He turned glittering eyes on the hooded woman. "Will the oblate please stand."

Thomas helped Ellen Welles to her feet.

"Mrs. Welles," said Speyer, "I now read to you the pertinent portion of Section 309 of the Patent Statute of 2002:

'If defendant be found guilty, the oblate (as herein above defined), shall be required to drink eight fluid ounces of water containing one gram of freshly mixed potassium cyanide. If the oblate refuses so to drink, the oblate shall be forcibly restrained by persons designated by the court, and shall be injected intravenously with five cubic centimeters of said potassium cyanide solution.'

"Do you understand what I have just read, Mrs. Welles?" asked Speyer.

The hooded head inclined slightly.

"The oblate signs in the affirmative," said Speyer to the court reporter. He said, "Mrs. Welles, will you drink, or shall we restrain and inject?"

She was heard to whisper something.

"Speak up," commanded Speyer harshly. "The reporter cannot hear your response."

"Mrs. Welles says that she will drink

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the liquid," said Thomas.

"Very well." The judge took a tiny golden key from an inner pocket and unlocked the glass case. His nose twitched. A faint odor—ammonia?—seemed to float from the opened case.

From a back door a nurse appeared, accompanied by two attendants who pushed a stretcher cart ahead of them.

Oh God, thought Quentin Thomas. To catch her as she falls.

Judge Speyer handed the encased syringe to the nurse, who ripped it from its sterile package, stuck the needle into the solution, and drew up a measured amount of liquid.

Speyer smiled in Ellen Welles's general direction. "That's just in case you change your mind about drinking, Mrs. Welles. Will you come forward, please?" In his mind he was already composing the opening paragraph of that tough antitrust case. He was about to get all the psychic energy he would need, plus plenty of extra for a quick revision. The text took shape in his mind's eye:

"Plaintiff, the United States, brought this action against defendant, Systems Motors, a New York corporation, alleging acts by defendant in restraint of trade, conspiracy, and monopolization, whereby defendant is alleged to violate the Sherman and Clayton Acts."

Ah, marvelous, marvelous! The law reviews would comment on it favorably as "bringing order out of chaos." It would be widely quoted in all subsequent antitrust decisions. It would rank with *The Talking Pictures Case*, *The Cellophane Case*, *The Univis Case*, *The General Electric Case*.

Thomas helped his client cross the room to the table at the dais.

"Take off your hood," said Speyer.

She did. Her face was like chalk, but her eyes were full and alive. She looked serenely up at Speyer.

"Are you ready?" he asked.

From the beginning, Quentin Thomas had foreseen this moment. In some undefined, theoretical way, he was now prepared. He had done the necessary things to his mind and body so that he retained a sort of automated function, a set of reliable reflexes. His knees held; he could stand. His hands shook a little, yet not too much. He wondered if his hand would take the glass and throw its contents at Speyer. He decided his hand would not do that. First, the judge was too far away; second, that would simply mean that the bailiff and his assistants would come forward with that syringe, and then Judge Speyer's smoldering eyes would feast on an even more interesting spectacle.

"I am ready," said Ellen Welles. She took the glass from the nurse, who held on to it with one hand. The condemned woman looked her murderer in the eye. She said, "Here's to your health, you sick sadistic bastard." She drank the entire contents without pause.

Thomas watched the lethal rhythm of her throat as the stuff went down. She returned the empty glass to the nurse.

Judge Speyer leaned over his bench, smiling, breathing in short gusts. "Under the circumstances, I forgive your outburst." A thin trickle of white foam began to inch its way down his chin.

I give her five seconds, thought Quentin Thomas.

Ten at the outside, thought Judge

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Speyer. Cyanide is fast. Tissues can't get oxygen. Something about destruction of oxidative enzymes. Convulsions. Then paralysis. Respiratory arrest. Death.

Nearly every person in the audience was now standing. Whether in respect, or out of curiosity, was not clear to counsel for the defense.

The two medics began to push their stretcher cart toward Ellen Welles. They reached her where she stood, and there they waited. One of them looked at his watch. Then the two exchanged puzzled glances.

Ellen Welles was whispering something to Quentin Thomas.

"What? What?" he said.

"It isn't working. The poison isn't working."

What she was saying was impossible. Perhaps it was too soon? But certainly she looked all right. Not the slightest trace of cyanosis. Skin dry. No difficulty breathing.

The nurse was puzzled too. She moved a step closer and took Ellen's pulse, then exchanged glances with the judge. "Something is wrong, your honor. I don't think the poison is effective."

Speyer frowned. "How can that be? We saw it freshly prepared this morning. We tested it. The mouse died in three seconds. Give her another minute or two."

The nurse shrugged. "Very well."

But three minutes went by. And nothing.

Thomas almost dared to hope. He turned around and faced the seats in the front rows. Where . . .? Yes, there he was . . . or *it* was, depending on the point of view. Faust. Hovering, watching. Faust had done this. But *how*?

Speyer was speaking again. "Well, forget the glass. Give her the syringe."

The two attendants stepped forward. They took her arms, and the nurse picked up the syringe.

"Now just a minute!" cried Quentin Thomas. "The sentence has already been executed! She drank the poison. The syringe can be used only if she refuses to drink. This is murder!"

"Mr. Thomas, you are in contempt," said Speyer. "Furthermore, it is not murder, but simply lawful execution. By your theory it would be perfectly legal for your client to undergo immediate treatment for cyanide poisoning, including artificial respiration, administration of amyl nitrite vapors, and sodium thiosulfate injection. The medical records report the case of a man who swallowed six grams and was saved by prompt treatment." He concluded grimly, "The oblate is required by law to die. Since she did not die by drinking, she must die by injection. We will use the needle with whatever restraint is necessary."

A massive metallic voice shattered the courtroom. "She will not die at all."

It was Faust, floating back into the sacrosanct zone of bench and counsel tables.

"Eject this—*thing*!" cried Speyer.

The bailiff and two burly policemen sidled cautiously toward the machine creature.

"Your honor," said Faust, "the solution in the glass *and* in the syringe is perfectly harmless. I deactivated it telekinetically. I simply caused the po-

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tassium cyanide molecules to react with water to form potassium hydroxide and ammonium formate. The potassium hydroxide then drove off the ammonia into the atmosphere. That was the ammoniacal odor you smelled when you opened the glass case. The solution is a little bitter, but no longer poisonous."

"You admit in open court," said the astonished Speyer, "before a hundred witnesses, that you have obstructed justice, and that you have interfered with lawful proceedings of this court? That you have, in effect, taken the law of this case into your own hands?"

"I do," said Faust.

Quentin Thomas wanted to warn Speyer: Don't press this, judge! You are dealing with forces beyond your wildest imagination!

But it was already too late. Faust called out: "Judge Speyer, I must tell you that the Fates—the Moira—have been at work. Robert Morrissey has played Klotho, the spinner, and now I, functioning as Lachesis, shall determine the length of the threads, for you, for Kull, and for Ordway. The finalities I leave to Atropos."

"Will you take him," barked Speyer to the bailiff and policemen, "or do I have to call the National Guard. Wha—!" His attention was diverted from Faust to something strange which seemed to be forming in the space below the ceiling of the courtroom.

The attendants holding Ellen Welles stared upward in unbelieving awe. Quentin Thomas promptly loosened their semi-paralyzed hold on the woman and led her back to her seat and the table. Here they watched the eerie aerial tableau take form.

Speyer recognized it first. "It's a web! A piece of spider web!" He added in wonder, "I can see the bottom circuit filaments. They are attached to a glass surface. It's a web in a terrarium . . . in someone's spider collection. *My* collection! I recognize the etching on the glass, and the mesh screen, with the feed trapdoor."

Ah, thought Quentin Thomas, like the others, half mesmerized, a spider web: that marvelous engineering feat. So beautiful and so deadly. The logarithmic filamentary spiral, around and around the radial spokes, starting on the perimeter and coming in toward the center, turn by turn. The huntress maintains a constant interval between the sticky strands by measuring with her leg. Wasn't there a paper where somebody (Sternlicht?) had derived *e*, the base of natural logarithms, correct to three decimal places, by measurements from several webs of the orb-weaver spiders? Rather like deriving *pi* by tossing sticks on a hardwood floor and measuring the angles made at the plank intersections. The strange, inexorable mathematics of nature.

And now there was movement along the web. Gigantic legs. The monster head. The elephantine abdomen.

Women began to scream. There was a concerted flight to the courtroom doors.

Faust's voice boomed out. "Ladies and gentlemen, leave if you like. But actually, there is nothing for the general audience to fear. This is but a projection. A spider, greatly magnified, but it cannot harm you."

Some left. Some turned and watched.

"It is . . . *Atropos?*" murmured

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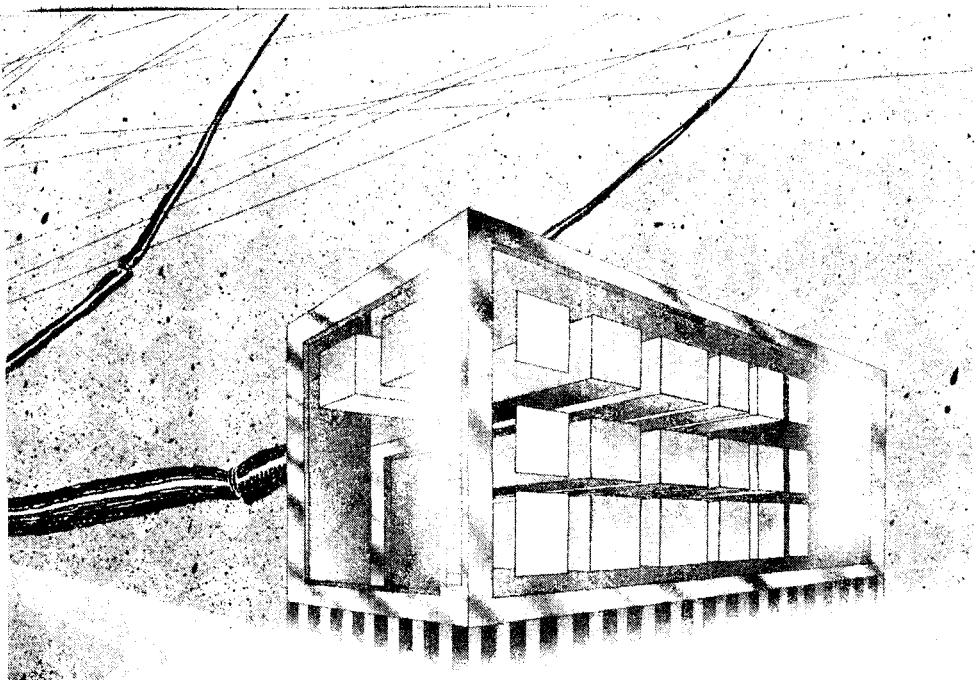

Speyer. "How is this possible?" He peered over the dais at Faust. "Are you doing this? Can you explain this?"

"Judge," said Faust, "I am responsible for this, and I can indeed explain it. Just as I said, it is a projection. As you have surmised, it is a projection into the glass cage of your favorite spider, Atropos. It is a projection into the future, but yet not the far distant future. In fact, it is quite like my earlier projection of the Supreme Court. Indeed, the events that you will soon see will take place in the future that lies but an hour away." The machine paused. And in that moment the roles of inquisitor and witness somehow reversed. "That would be her normal feeding time?" asked Faust.

"More or less," said Speyer.

"Three flies?"

"Generally."

"And the silly little creatures fly right into her web?"

"Yes."

"And the world is better off without the three insects?" continued Faust.

"Of course," agreed Speyer.

"So that Atropos is but performing a social service?"

"Quite right," said the hypnotized judge.

"Oh no!" gasped Quentin Thomas. For the first time he sensed what was coming. He turned a horrified face toward Faust. "Don't do this!" he cried.

Faust ignored him.

Speyer seemed to recover partially from the spell cast on him by the projection and his colloquy with Faust. He

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banged his gavel. "Be quiet, Mr. Thomas. I want to see this. Ah yes. And there they go. Three flies. I am home, feeding my little friend."

"You fool, you fool," moaned Thomas.

Three black blobs were suddenly visible, struggling in the web strands.

"Ah, there they are," cried Speyer. "Now comes the best part." He looked over at Faust. "Can you get the magnification up a little?"

"Yes."

One of the black points on the silken entrapment was flailing about, and every movement it made seemed to entangle it further.

Speyer leaned forward. His eyes grew wider. Then he gasped. "But that's not a *fly*. It's a human being. I see a face. It's . . . Mr. Kull!"

Jethro Kull, seated at the counsel table with his lawyer, Mr. Ordway, slumped over on the table.

Fainted, passed out, thought Quentin Thomas grimly. Can't say as I blame him.

Stunned faces watched the scene shift along the web to the next blob. The magnification and focus were excellent. The face was clearly visible. It was Ordway, and he was caught and struggling.

"My God!" shrieked the real and present Ordway. "No! No!" He struggled to his feet.

But the scene shifted again. They saw the spider once more—or parts of her. She seemed to be fairly stationary, but her legs were pumping rapidly, methodically. She was working busily on the third blob, whirling it over and over like a spindle, wrapping it tightly with her silken threads into a glistening cocoon. Somehow an arm got out, waved frantically, but was quickly bound back into immobility. The focus moved a little, and now the head was visible. On this head the mouth was wide open and was screaming. Despite the contorted features, the face was evidently that of Judge Speyer.

"We can turn up the sound," said Faust mildly.

Shrieks filled the courtroom. Quentin Thomas felt the flesh crawl along his paralyzed back.

Atropos took the head within her mandibles. The watchers saw the scythe-shaped fangs unsheath. It was all very leisurely. From somewhere behind the spider, a movement of the strands indicated to her that her other guests clamored for attention. But they could wait.

Crunch.

The screaming stopped. There was a dead silence in the room. Thomas listened to the beat of his heart. Lub dup, lub dup . . . From somewhere back of him there was a slow slumping noise. Somebody had fainted.

As the spider's poison needles withdrew, Thomas thought he could see a tiny gout of dark liquid dangling from one of them.

The scene faded.

The red-robed defense lawyer looked up at the bench. Judge Speyer's mouth was wide open. He seemed stunned, unable to breathe. Then his face seemed slowly to fade. He disappeared—as if into thin air.

Thomas looked about him quickly. There was a stir around plaintiff's table. Jones, Ordway's number two man,

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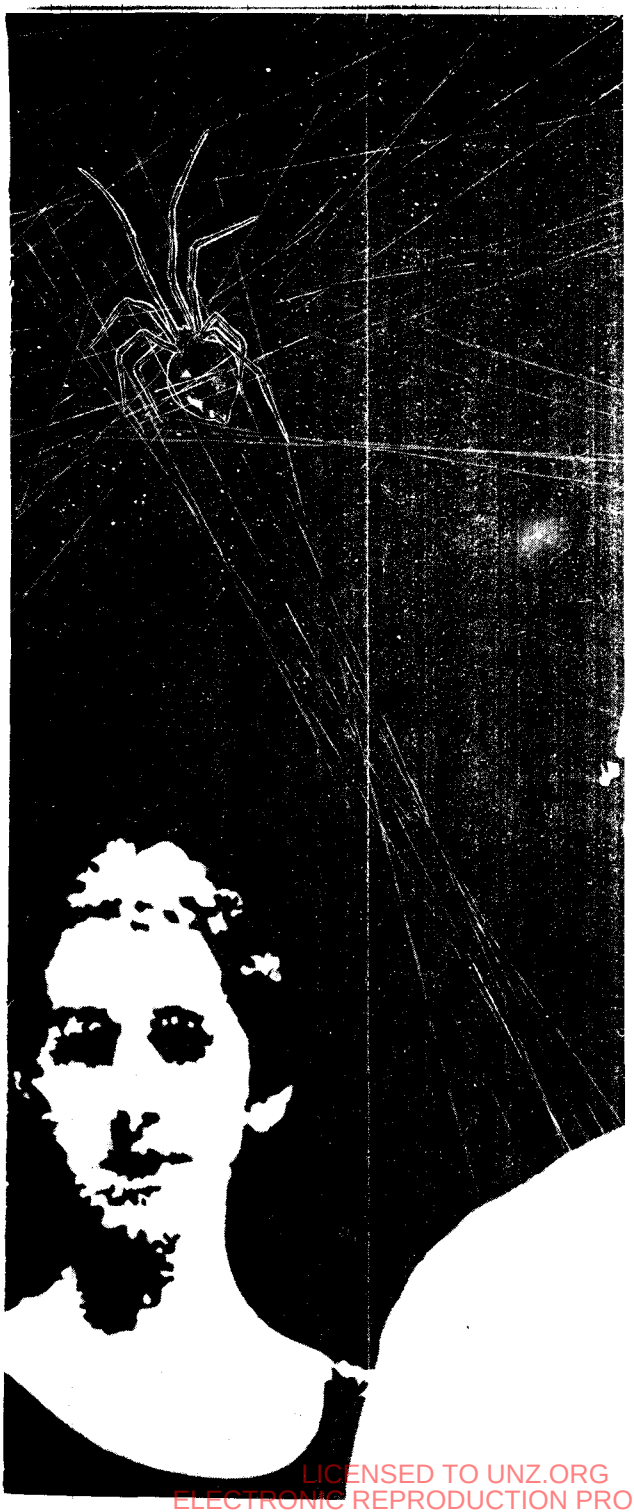

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looked over at Thomas in total horror. "They're gone! The chief, and Mr. Kull—gone! They simply vanished!"

"Yes!" clipped Thomas. "Get the hell out, Jones." He grabbed Ellen Welles by the arm. "We're leaving, too, but first let's catch Faust. I have a couple of questions for him."

They worked their way over to where the impassive computer was hovering.

"Dammit," accused Thomas, "did you *have* to do that?"

"Do what, Mr. Thomas?" said Faust. "Save the life of your client by acts, when you were unable to accomplish this by mere words? Your concern truly mystifies me. Everyone got what he wanted."

"How can you possibly say that?"

"You won. You'll get a dismissal when this case is reopened. Mrs. Welles is alive, with no immediate prospects of departing this life. And I shall soon free Robert Morrissey."

"But . . . but, Speyer?"

"He complained that he couldn't really compare Fiber K with Atropos's filament, because he had no contact with Atropos's filament. He can no longer sustain that objection."

Was this creature serious? Quentin Thomas wasn't sure he wanted to know. "But how about Kull and Ordway?"

"They got their wish, too. They wanted to hold on to their filament for the rest of their natural lives. And they did; perhaps even a little longer."

"I see," said Thomas dryly. "And I suppose you got what you wanted?"

"You refer doubtless to the satisfaction I experienced in providing supper to a poor caged creature."

Human? Inhuman? thought Thomas. In the cruelty of his ironies Faust was entirely *too* human. Nothing made sense anymore. Yet there was one final nagging question, and he was going to ask it. "You did almost everything you said—telekinetic control of chemical process, shrinkage of matter, matter transport, projection into the future. But how about that last thing . . ."

"Treatment of human diseases? For example, a cure for leukemia?"

"You know that's what I mean."

"Think back to the glass of cyanide," said Faust. "After I detoxified it, I converted the remaining ion population to my new drug. Mrs. Welles should show signs of remission within a few days. She should schedule a check-up. I have to leave now. Robert Morrissey and I have an engagement in another continuum."

"But where . . . how can I reach . . .?"

But it was no use. Faust was fading. The lawyer could see *through* the machine. He picked up a startled human face on the other side, and then Faust was gone altogether.

"He *smiled*," said Ellen Welles in wonder.

"But he has no face," said Thomas.

"He smiled," she said.

He watched her walk away. It was a firm jaunty step, neatly paced out with her high heels. It was efficient, yet slow enough to have an element of languor. She was saying something to him with her body.

He was thoughtful. As co-owners of a thriving little corporation, they really ought to see more of each other. He just might recoup some of his losses, one way or another. ■

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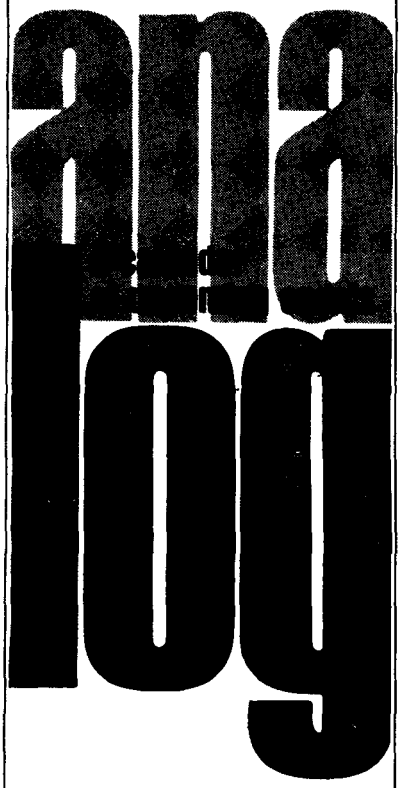

4-5 April
University of New Hampshire Simulations Games Club Spring Gaming Festival at Durham, N.H. Info: R. Bradford Chase, UNH Simulations Games Club, Memorial Union Building, University of New Hampshire, Durham, NH 03824.

7-9 April
Electro/81 Show and Convention (IEEE and others) at New York, N.Y. Info: Robert Myers, Electronic Conventions, Inc., 999 N. Sepulveda Blvd., El Segunda CA 90245.

11 April
URCON III (Rochester area SF conference) at University of Rochester, N.Y. Info: Urcon III, P.O. Box 6647, University of Rochester, River Station, Rochester NY 14627.

13-15 April
Miami International Symposium on Metal Hydrogen Systems at Miami Beach, Fla. Info: Clean Energy Research Institute, School of Engineering and Architecture, P.O. Box 248294, Coral Gables FL 33124

20-23 April
General meeting of the American Physical Society at Baltimore, Md. Info: American Physical Society, 335 East 45th Street, New York NY 10017.

24-26 April
ELECTRA-CON I (Nebraska area SF conference) at Ramada Inn, Kearney, Neb. Guests of Honor—Ed Bryant (Pro), Suzanne Carnival (fan), Dan Patterson (artist). Registration—$7.50 in advance, $10 at the door. Info: Electra-con I, P.O. Box 1052, Kearney NE 68847. Send S.A.S.E.

2-7 September
1981 DENVENTION II (39th World Science Fiction Convention) at Denver Hilton, Denver, Colorado. Guests of Honor—C. L. Moore and Clifford Simak, Fan Guest of Honor—Rusty Hevelin, Toastmaster—Edwart Bryant. This is the SF universe's annual get-together. Professionals and readers from all over the world will be in attendance. Talks, panels, films, fancy dress competition, the works. Join now and get to nominate and vote for the Hugo awards and the John W. Campbell Award for Best New Writer. Info: Denvention II, P.O. Box 11545, Denver CO 80211. 303-433-9774.

—by Anthony Lewis

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THE REFERENCE LIBRARY

By Tom Easton

The Dead Zone, Stephen King, Signet, $3.50, 403 pp.
The Devil's Game, Poul Anderson, Pocket Books, $2.25, 219 pp.
City Come A-Walkin', John Shirley, Dell, $1.95, 204 pp.
Dangerous Games, Marta Randall, Pocket Books, $2.95, 499 pp.
The Spinner, Doris Piserchia, DAW, $1.95, 176 pp.
Thousand-Star, Piers Anthony, Avon, $2.25, 294 pp.
The Dreaming Dragons, Damien Broderick, Pocket Books, $2.25, 174 pp.
The Berkley Showcase, *Vol. 2,* Victoria Schochet and John Silbersack, eds., Berkley, $2.25, 200 pp.
Foreign Constellations: The Fantastic Worlds of John Brunner, John Brunner, Everest House, $8.95, 188 pp.
Science Fiction Writer's Workshop—I, Barry B. Longyear, Owlswick Press, $5.95, 161 pp.
Unfinished Tales of Numenor and Middle-earth by J.R.R. Tolkien, Christopher Tolkien, ed., Houghton Mifflin, $15.00, 472 pp.

It was most of a year ago that Spider reviewed Steve King's *The Stand.* In the process, he bugged me more than a little, perhaps partly because I'm a provincial fellow whose hackles rise whenever I feel that one of my in-groups is being attacked. They rise when a "literateur" puts down SF, and they rise when anyone—in or out of SF—is less than kind to a neighbor. And Steve King is a neighbor; he is one of the very few SF writers who call the state of Maine home. I thereby feel a certain sense of kinship with him (though, really, not a strong one). I haven't rushed to his defense before now because I *do* know the difference between a rational bias and an irrational one. I defend him now because I have a good excuse: **The Dead Zone.**

Spider knocked *The Stand* on the grounds that King displayed in it a profound anti-technological bias, a belief that dreams, faith, and gut feelings were more trustworthy than reason. I don't agree. What Spider saw, I think, would be better interpreted as a bias against destructive technology and for self-reliance. His good guys follow the divinely inspired dreams of an old black woman, true, but they also follow the dictum that "God helps those who help themselves." His bad guys follow the

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devil incarnate (modeled, I suspect, on a certain ex-president), completely abnegating their own wills; and for all their love of technology, they belong to the occult far more than do the good guys.

The Dead Zone makes some of the same points. The book's protagonist, Johnny Smith, is a young teacher who awakens with clairvoyance from over four years in a coma. He can see much of the future, except for place names—they lie in a "dead zone" served by a bit of brain tissue destroyed in the car crash that caused his coma. When he is released from the hospital, he uses his talent to try to forestall disaster (a prom party is scheduled for a restaurant he knows will burn, killing dozens), to find a murderer, and to investigate an *evil* politician. In the end, he faces a hard, hard decision; one that tests his will, one that points up the difference between self-reliance and self-abnegation.

Technology doesn't enter into this tale. The occult does, however, for Johnny's talent *is* occult. It is of the light, though, not the dark; and he uses it to fight for the good. And here is the key to King's choice of themes. He writes of good versus evil, putting a usually shaded white up against the blackest black. He uses the occult, I suspect, solely because it lends itself to tales of horror, and perhaps because it makes good and evil seem more akin. Yet he treats it as rationally as he can, given its nature. It is a source of power, but one with limits that restrict his heroes. And, at least in *The Dead Zone*, it is not quite the sort of occult beloved of the masses. On that silliness he heaps scorn. Johnny's mother goes all out for flying saucers, interstellar and subpolar True Christians, and all the other goodies in the cosmic fruitcake. An occult-oriented tabloid seeks Johnny as a "house psychic" and gets the bum's rush. Fans are avoided like the ten plagues of Israel.

Does Steve King write science fiction? It's a fair question, for to most people he is a horror writer, a fantasist. But his premises that the occult (especially ESP) is real and evil can be personified are hardly foreign to our field. And he is as much a rationalist, free-will advocate, and moral reactionary ("absolutist," as opposed to "relativist"; he does not believe that society makes evil, even though he does use background to flesh out his evil characters) as that demigod of SF, Robert A. Heinlein.

King's works have their fantasy components, sometimes more strongly than others, but at least his latest are indeed SF. *The Stand* and *The Dead Zone* are both examples. And they are both ripping good stories. For all their length, I enjoyed both tremendously, and I'm looking forward to reading his next.

Speaking of the occult, let's have a look at another example, perhaps a shade less blatant than King's. Poul Anderson has departed from his more usual course to give us **The Devil's Game,** in which an apparition called Samael helps a young executive become a multibillionaire and then spurs the man to set up a fiendish game. Is Samael a devil? Is he perhaps an alien studying Earthlings? Anderson refuses to say, for though this touch of the occult motivates the story, it is not the story itself. That is seven people, each with a need for money, playing Follow-the-Leader for a million-dollar (take-home) pot. Each one must devise a task for all to perform. After each has had his or her turn, the pot will be divided among the lucky few who have met all

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the challenges. Only then can they leave their "benefactor's" Caribbean island home.

The situation is pregnant with possibility, for the characters are a diverse lot: housewife, playboy, revolutionary, mafioso, businessman, tart, and professional failure. And Anderson lets it give birth to a wealth of conflict. Yet *Game* is not an action yarn; it is a character study, and as such it is both interesting and readable. It also casts an intriguing sidelight on a master's talents, for it shows indisputably that he is more than a master of epic adventure. (Does anyone really need the message?)

And now for one you music fans are gonna dig—a rock novel, hard driving, hard stomping, all high amp and heavy bass. It's John Shirley's **City Come A-Walkin',** and don't let the unlikely premise put you off. A city comes alive, indeed, embodying the collective unconscious of its residents. It animates bodies to stalk its own streets in search of those who threaten its existence. Its voice rides TV cables, and machinery hums to speak to hero Cole, nightclub owner and city-lover. It flexes sinews of sewer pipe and I-beam. It fears and hates the coalition of Mafia and government that seeks to use Electronic Funds Transfer and modern communications to disperse its populace across the countryside and abolish it itself.

The city in question is San Francisco. I don't know the town, so the orgy of shooting, bombing, kidnapping, and assorted mayhem the city instigates seems unlikely to me. I'd believe it more of Chicago or New York. At the same time, though, I do believe the various crazies Shirley puts on paper, from unionizing prostitutes to vigilantes. (They do fit the California image, don't they?) And I love the use Shirley makes of them, especially the scene in which the vigilantes invade a rock concert and the city takes over the auditorium's holographic light show to goad the audience into swamping the vigilantes.

But enough of that. The story is fast-paced, lively, at times saucy, and the prose has a rhythm reminiscent of rock music. It's a good read, too, and it even offers a profundity or two. When the electronic revolution finally does arrive, it may well tend to make cities superfluous. When that day comes, there will be resentment in plenty among city-dwellers and city-lovers. That resentment surely won't take the particular form Shirley dreams of, but it just might provoke a new protest movement. It might even spark terrorism and revolution.

I'm glad I already live in the country. All I fear from that future is a sudden horde of new neighbors.

Marta Randall's **Dangerous Games** is a more standard brand of SF. Its universe is one whose people range among the stars, where worlds are owned by corporations and families, where corporate takeovers can mean literal interstellar war. In this cosmos, we have Sandro Marquez, scion of a clan whose world has been lost to Parallax, a greedy giant of a company that tyrannizes its possessions. He blames the loss in part on the Kennerins, a directly competing family; yet he is soon allied with them, mate on a starship and peripheral witness to the events surrounding them. He is there when Jes Kennerin acquires the cat-woman Tatha and her babe from Gensco Station, an outfit that guarantees its employees' loyalty by such tactics as holding their children as hostages. He is there when the Kennerins's own genetic engineer, Hart, is punished for his early, clumsy experi-

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ments on the natives of the Kennerin world, Aerie. And he is there to help when Parallax aims a takeover bid at Aerie.

Part of the book has appeared as an *F&SF* novelet. It stands out, too, for even though the book is organized episodically, it is pervaded by a sense of familial ties that here fades away, or at least takes a different, more personal focus. Yet it hardly spoils the book. The story as a whole is strong enough to withstand such a weakening, and it remains a book worth reading.

Doris Piserchia has written some highly interesting material since her arrival in SF a few years back. I've enjoyed most of it, though I *have* found occasion for unkind words. Now we have **The Spinner,** and while I did enjoy it, I do have more unkind words. The story begins when a mad (*very* agoraphobic) scientist bursts the barrier between Earth and Elsewhere and admits a man-eating, bitterly malevolent horror. Man-like in form, the alien encases a town in webs, traps people, hangs them up to suffer, dines at will, finds crazed allies, and laughs at snipers, tanks, flame-throwers, and other weaponry. He is baffled only by an odd youth, product of a second mad scientist's tampering with the brain, who dodges webs and spinner alike while clad in red longjohns.

Ha. And again ha. Mad scientists. Superman. Bugeyed monster. Parody? Tongue in cheek? Maybe. Especially if you consider the colony of elder citizens who have fled their nursing homes for the caves beneath the town, for whom their descendants' disasters are a mere annoyance. They shelter the superman, shoplift for supplies, and know the only way past the webs and out of town. And they are mostly out of their gourds.

It should be funny. But it isn't, not often enough. The reason may be that Piserchia keeps her face *too* straight—the secret of humor is to tell outrageous lies as if they were true, but SF is based on outrageous lies, and SF humor needs something more (don't ask me what). Or perhaps the reason is that DAW failed to recognize the humor; the jacket copy promises "a novel of constantly growing horror and rising menace," not "a laugh a page." Or did Piserchia intend us to take it seriously? If she did, she forgot that the time for stories like *Spinner* has long since come and gone. She forgot that writer's bane, the dread anachronism.

Speaking of humor, Piers Anthony gave us a very nice belt in the funnybone early in his career, with *Prostho Plus*. Since then, he has moved into fairly mystical territory, telling us that intelligence, identity, and personality reside in Kirlian auras, which can be transmitted from one person to another across interstellar distances. It's a claptrap premise, but it does allow some interesting situations—what is it like for a human to share an alien body? It also allows wide-ranging stories that duck the Einstein barrier, for though spaceships can't crack the speed of light, aural transmission is (of course) instantaneous.

And that is what we find in **Thousand-Star,** a tale set in the Thousand-Star Cluster, where an artifact left behind by the mysterious Ancients has been found. Protocol demands that all interested species take part in a race to the artifact, winner to gain custody. The limits of Anthony's technology dictate that each species' specially trained representative must occupy the body of a local sapient, so that the human rep becomes a tenant of an amoeboid energy-

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eater. However, the human, Jessica, is untrained; at the last minute she substitutes for her injured male clone-twin. Her host, Heem, is both a criminal and male, and the male-female pairing is supposed to be impossible (aural transfer is accepted as the definitive criterion when sex is in doubt). Yet it happens, and Heem and Jessica find a unique *modus vivendi*, one that hinges on certain peculiarities of Jessica's aristocratic home culture, where she lacks a suitable marriage.

I've read several of Anthony's latest books, and I'm still not sure I like them. They don't grip, but they don't repel, either. What do they do? I confess perplexity. His plots are easy to summarize: here, the race. The complications are not, for he is given to baroquely ornamented personal histories and interactions that make his SF read more like fantasy. His creatures—blue humans, talking amoebae, snakes with claws, and walking plants whose flowers can be either death-ray generators or power drills—and his science prove him fey. Perhaps I should simply say that, when I read him, I feel estranged. I witness the man's admittedly marvelous imagination as through a glass, darkly, with all participation in the story barred. Yet I wish for more, and I pick up each of his books in turn, hoping each time that now, finally, the glass will break. It hasn't so far, and I'm about ready to give up.

Still mit der auras, folks! They play a fair role in Australian Damien Broderick's **The Dreaming Dragons,** along with astral projection, out-of-body-experiences (OOBE's), and the collective unconscious. Anthropologist Alf Dean and his autistic nephew Hieronymus (better known as Mouse), in hot pursuit of the foundation of the Aboriginal Rainbow Serpent legend, stumble on a cavern containing a Gate that teleports them into the depths of a secret research project. It seems that the Apollo astronauts found something on the moon: a half-destroyed base with a map that pinpointed a strange artifact on Earth. From the base, scientists have learned to generate a "gluon field," the anti-Bomb shield of so much SF, similar to the field that protects the artifact from meddling.

Alf and Mouse get too close to the artifact, a gleaming egg. Alf suffers nightmares in which dragons speak to him and he wanders from his body. Mouse becomes a conduit for data he has never learned. Bill delFord, OOBE expert, is brought in from his Big Sur research institute, and his conflicts with hide-bound military brass become highly entertaining. And the truth emerges, mostly through Mouse; delFord seems little more than a mechanism the author can use to tell the reader all about OOBEs, astral projection, and so on.

The egg, it seems, is the product of an alternate Earth, built by descendants of the dinosaurs. It is also part of a time machine with which the dragons planned to bring their ancestors the blessings of intelligence and knowledge. Thanks to a nearby nova, however, the machine was damaged on its journey back through time, overshot its mark, and was directly responsible for the extinction of the dragons' primitive predecessors and the evolution of humanity. There is more, too, for the egg has a great deal to do with the collective unconscious, but I really shouldn't go into the details—the end of the book hinges on them too strongly. Suffice it to say that Broderick's story is amusing, entertaining, and even thoughtful. And the science—the biology, anthropology, and physics—is all either sound enough or

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glib enough that one doesn't have to balk, though strictly speaking the premises *are* so much hogwash. Broderick tells a good tale. Enjoy.

Berkley's SF department is now putting out a periodic anthology, the **Berkley Showcase.** I have Volume 2 here, and I can say it's not bad. The best story in the book may be the lead, Glen Cook's "Soldier of an Empire Unacquainted with Defeat," in which a defector from the defeated Dread Empire's army strives to bring peace to a forgotten valley. Then again, it may be the last, Tom Disch's "The Foetus," a tale of satanic ungrowth, evil control, and more evil dreams. It is not Lafferty's "Lord Torpedo, Lord Gyroscope," a minor bit of frenzied nonsense. Nor is it Ed Bryant's plotless exercise, "To See," or Freff's homage to a mad scientist, "Hear Today." It might be Karl Hansen's "Doll's Eyes," a tale set in that future belonging to his sail-racers, sirens, and neuropeptide-secreting thrill-peddlers, but it seems to have a severe problem in that it requires having read other tales of his to know what is going on, *and* it seems less than entirely consistent with those other tales.

Whatever, Schochet and Silbersack show a taste for that variety of modern SF best called surrealism, for this quality of being set at an angle to normal reality marks all the stories in this volume except the Cook. And this strikes me as more than a little queer, for they close this same book with Shawna McCarthy's interview with Barry Longyear, as unsurrealistic a writer as you could hope to find. He is, in fact, a writer who fits comfortably into *Analog's* pages; and it is his realistic, thoughtful, empathic work, as expressed so well in "Enemy Mine," "Savage Planet," and the like, that earned him 1980's Nebula, Hugo, and Campbell awards, an unprecedented triple play. I just don't see how he fits this anthology, even as an interviewee, unless the fit is simply because Berkley is bringing out his books.

I find myself with a lukewarm reaction to John Brunner's **Foreign Constellations.** The man has been responsible for some memorable SF, both long and short, and he enjoys an enviable reputation. It is therefore interesting to look at his collection of eight recent short fictions, most from the 1970s, and find that only three seem worth remembering. These are the only ones that echo across the years from their first readings. The others, at least those I read when they first appeared, are lost with all the rest of the ephemerae, and one of them is only two or three years old.

The good ones: "Out of Mindshot" (1970) tells how a range limit on telepathy can let a telepath avenge herself on an oppressor; "The Taste of the Dish and the Savour of the Day" (1977) describes the perfect food and a conflict between the good life and the long life; "What Friends Are For" (1974) shows us how cultural relativism might provide the detachment so necessary in bringing up problem children. All three are told smoothly and with proper regard for the author's voice ("Taste," for instance, has a distinctly Old World flavor of decayed opulence). All three involve the reader and make a point of some worth.

What's wrong with the other five? "The Berendt Conversion" (1975) scrambles fantasy and reality and adds a self-serving afterword. "The Easy Way Out" (1971) offers a new version of the old solipsistic "And then I woke up" ending. "Pond Water" (1968) is both pointless and unlikely. "The Pro-

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tocols of the Elders of Britain'' (1974), intended as a cynic's cry of despair and warning, degenerates into bathos. ''The Suicide of Man'' (1978) is a ghost story, both cosmic and prosaic, and the combination fails to move the reader. None of the five are badly or clumsily written, but their themes and voices fail to appeal to me. Why? The three I called memorable may share a certain upbeat character, and four of the five are downbeat, but that can't be it. I have enjoyed some of Brunner's most depressing work. So what's the answer? I can't say; and if I pretended to be a critic, I would feel I was shirking my responsibility to you dear readers by stopping there. But I'm a book reviewer, folks, so I just have to say that *Constellations* strikes me as a so-so book and hope that I've said enough to let you make up your own minds.

I've mentioned Barry Longyear and his triple play once already. I do it again because as soon as he got home from Noreascon he called me up, obviously floating on Cloud 999. He wanted to tell me the news and—since now nothing could possibly hurt him—offer to send me a copy of his latest, the **Science Fiction Writer's Workshop—I.**

The book is both a guide to conducting workshops on the writing of SF and a text for would-be SF writers. To boot, it is more than worth telling all you readers who might one day try your hands at a story about it. Remember Ben Bova's *Notes to a Science Fiction Writer*, advertised so well in these pages? Barry takes a similar approach, using his own stories to illustrate his points, but he goes into the writing process in much more detail than Ben. Furthermore, he shows you not only his published successes, but also a few of his flops; something that has to encourage the novice, especially when that novice realizes that even the high and the mighty can commit slushpile atrocities.

In nine chapters, Barry tells you about how a story is structured; how to begin one; how to fill in background; how to pick titles; write build-ups, bright moments, and dark moments; plant clues; shape endings; and paper-over the cracks between scenes; how to use points of view; how to construct non-cardboard characters; how to recognize fatal flaws; how to incubate a story; and how to approach editors. The chapter on fatal flaws is particularly interesting, for it is here that he shows off his own gaffes (though at least one of his flawed tales, ''Please Give,'' did not strike me as such a horrible example; I have seen far worse in print, and it *is* a rather nice idea).

For all the brevity of his career to date, Barry is an accomplished writer. He has shown us this in his fiction, and now he does it again with nonfiction. He explains well and illustrates better, and you could not ask for a more effective teacher. If you have any hope of becoming a SF—or other—writer, buy *Workshop*. It will help you more than any three other texts.

Worth noting is Tolkien's **Unfinished Tales,** a collection of variations, fragments, and new materials that fleshes out our knowledge of Istari, Palantiri, Druedain, and much more. It is even less connected than the *Silmarillion*, and there are discrepancies between its stories and others elsewhere, for Tolkien apparently loved to compose different versions, trying them on for size and picking and choosing among them when he composed his final drafts. The book is for Tolkien fans, so if you're one—enjoy. ■

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BRASS TACKS

Dear Stan:

Your friend Diogenes Jones (August 1980) is a pretty smart fellow. Diogenes and his like-minded friends are pursuing the only sensible course in these "energy-short" times, the one that will maximize benefit for everyone.

Of course, like most people Diogenes has some of his perceptions a little skewed. He doesn't realize we are no more going to run out of crude oil than we ran out of whale oil. And he doesn't seem to understand that our situation isn't caused by an energy shortage. Or that the oil companies have played a vital part in the problem by holding the price of oil too low.

These aren't points that are immediately obvious. It doesn't help that we've all had semantic sand kicked in our eyes by people who don't say all of what they mean.

Let's take it apart—starting with what an actor would call "sub-text," the unspoken parts of the argument.

I) What Diogenes Jones and people like him mean is: "I am going to continue to use crude oil the way I always have *until something better or cheaper comes along.*" The italicized part is what he didn't say out loud.

John Campbell once observed that people want technology to be the equivalent of magic, which he defined as "product without process." As long as his comforts are there at a reasonable price, Diogenes doesn't care if they are produced with energy from crude oil, nuclear power, or voodoo. Just like his great-grandfather, Socrates Jones, who didn't care whether he burned whale oil or kerosene in his lamps.

Diogenes will conserve if he has no alternative, or if the cost becomes too high. But he'd rather fulfill his wants than do without.

II) What the experts and doomsayers are telling us is: "We are going to run out of crude oil in 20/50/100 years *at present/projected rates of consumption.*" The number doesn't matter much, but that oft-omitted and little-noted qualifier does.

We are not going to continue to use crude oil at our present rate of consumption and the projected rates are far too high. During this decade our consumption is going to stabilize and then drop like a rock. This has already started to happen and as this is written OPEC's oil ministers are meeting to try to deal with the world oil glut. They will probably try to restrict production.

As the price of crude continues to

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rise, consumption will fall. In 100 years there will still be plenty of crude for whatever we will use it for then. But it will be too expensive to use as we use it today.

That's why we have plenty of whale oil. It cost too much for old Socrates Jones to burn, so he switched to new-fangled kerosene—which came on the market because Socrates and his neighbors kicked about the price of whale oil.

All this hasn't been clear to us over the past decade, because even with the massive price rises, crude oil has been the most economical fuel around. In fact, if crude oil were priced like copper or breadfast cereal, it would *still* be the most economical fuel around.

Except in limited and highly anomalous circumstances, the price of anything will fall between the cost of producing it and the "economic replacement cost;" that is, the price of a substitute or the cost of just doing without. You can't sell below the cost of production and people won't buy above the economic cost of replacement. (Government subsidies and such don't change this; they just shift some of the cost to the taxpayers. Even absolutely forbidding a commodity only increases the price because it drives up the cost of production and distribution. Witness marijuana.)

Breakfast cereal, copper, and nearly everything else we buy is priced according to the cost of production with something thrown in for profit. Oil isn't. Since the highly competitive American oil industry became unable to meet our needs in about 1970, control of the world oil supply has passed to an oligopoly, OPEC. (And yes, the American oil *producers* were highly competitive.)

There is a tendency towards oligopoly in any industry, particularly one as capital-intensive as oil. And there is a strong tendency for an oligopoly to charge all the traffic will bear.

As of 1980, crude oil is not scarce and it is not very expensive for OPEC nations to produce. The cost of producing a barrel of oil in Saudi Arabia or Libya isn't much higher than it was when that barrel would have sold for about $5. The extra billions we pay the OPEC nations is a charge for doing business with an oligopoly.

OPEC can get away with charging us so much because historically oil has been tremendously underpriced compared to any other energy source. From 1940 until 1967 the price of gasoline in the United States actually *declined* by nearly half! If you allow for inflation, a gallon of gasoline costs us 19¢ today in 1941 dollars and 45¢ in 1967 dollars. The price at the pump was about 19¢ in 1941 and down to about 10¢ in 1941 dollars by 1967. Cost of production declined in those years, so the oil companies passed the savings on to their customers. We would be better off today if they had raised their prices to keep pace with inflation. In fact, you can make a case for low petroleum prices from the big oil companies as the cause of our present energy problems.

For over 50 years energy from oil and gas has been so much cheaper than any alternative (except hydro-electric) that it has driven most of them from the market. Diogenes Jones's grandfather, Pythagoras Jones (old Socrates's son) experimented with solar power and windmills, but he abandoned them for cheap oil and gas.

It has taken oil a long time to reach the economic cost of replacement. And because it took so long a lot of people assumed oil was somehow immune from the basic laws of economics. That notion is in back of a lot of the debates,

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laws, regulations, handwringing, and other silliness we've been treated to since 1973.

To understand what was really going on, consider the story of the $75 Porsche.

The tale has passed into folklore of the businessman who ran off with his secretary and asked his wife to sell his $25,000 sports car and send him the money. So the wife sold it—for $75.

The lucky buyer in the story got a smoking deal. If someone offered you a Porsche for $75, would you take it? The answer is almost certainly yes. Even if you don't like Porsches.

What if the price was $750? A majority of people would probably still say yes. They'd borrow the money just to cash in on the bargain. What about $7,500? Here most people would drop out. It's perhaps one-third of the car's value, but it's too much money.

The point is that for Porsches, price elasticity doesn't set in until somewhere between 10 and 100 times the asking price in the story. *And until you hit the point of price elasticity, price increases have no effect at all.*

Oil has been the $75 Porsche of the energy world and the actions of the OPEC cartel didn't bring it to the point of price elasticity until sometime in the last year to 18 months.

Sheikh Ahmed Yamani, Saudi Arabia's oil minister and chairman of OPEC's long-term study committee, has been quoted as saying the economic cost of replacement of oil is about $30 a barrel. A former OPEC official has calculated that various synthetic fuels become cost-competitive with oil at prices ranging from $15 to $60 a barrel equivalent and that most could be cost-competitive at less than the present average price of $35 a barrel.

It is no accident that the last year has seen a wave of interest and action on alternate energy production which is approaching tidal wave proportions.

Now the Diogenes Joneses of the world can maximize their utilities by switching to other energy sources. The process will take a little time because of the size of our economy and the artificially high oil dependence built into it. But in this decade we will begin to convert with neck-snapping speed.

By waiting until it was economic to make the switch, Diogenes has maximized his utilities, created the greatest possible satisfactions for himself and conserved the resources of his society most efficently. Could he have made the switch in 1973 when the "energy crisis" was first announced? Possibly, but he would have squandered his wealth and his society's wealth in doing it.

Goods and services that could have gone to purchase a new car, or a moon shot, or to provide food stamps, would have been diverted into alternate energy sources that were not yet needed. Until oil reached its economic replacement cost, those alternate sources would be operating at a loss.

The research and development done in the past seven years has been important to securing our energy future. But everything else has been pretty much waste motion. All the handwringing, all the laws, the whole forest of government regulation and all the running around and shouting meant absolutely nothing. The rising price of oil and our research efforts meant everything.

This is not a popular line of argument. It is not emotionally satisfying. It is characterized by the kind of paradoxes that make energy economics so hard to understand. It doesn't fit with anyone's preconceptions. You can't even work up a good load of White

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Western Liberal guilt and doom with it.

All you have to do, the argument says, is to keep on like you always have and wait for the price of petroleum to hit the economic cost of replacement. Then, like Cadmus's dragon's teeth, alternatives spring up from the ground at you. If you don't look too closely at the research and engineering that went on while we waited, it looks like magic.

And it's about as close to product without process as you'll ever get.

RICK COOK

Phoenix, AZ

The $75 Porsche is indeed crucial—and I've recently seen signs of the same effect starting to show up in other areas where supply-and-demand seemed to have been inoperative for a while.

Dear Dr. Schmidt:

I was pleased to see "The Physics of Haunting." It is representative of exactly the type of approach and method we can expect to be successful in investigating such phenomena, if any success at all is to be had. Relating an observed phenomenon to possible cause by means of established laws of physics with which we (some of us, anyway) are quite familiar ultimately enables the phenomenon itself to be eventually integrated into our "accepted wisdom." How feasible would that be if such things were regarded as the "Irreproducible Phenomena" of your September 1979 editorial? (Just thought I'd insert that barb in passing; perhaps this time it will generate response from some other readers!)

MICHAEL PARMENTER

Sedalio, CO

I agree, up to a point: we should certainly try first *to fit new observations into the existing theoretical framework. The point of "Irreproducible Phenomena," which you seem either to have missed or to be unwilling to acknowledge, is that there* may *exist some phenomena which really* don't *fit that framework—and if so, we'd do well to be open-minded enough to consider other possibilities.*

Dear Stan,

In my October 1980 Analog article, "The Physics of Haunting," I pointed out that certain reported ghostly phenomena conform surprisingly well to the known laws of physics. Analysis of those phenomena revealed that the human soul might be detected by weighing persons as they die, and that the human soul might be found to weigh between approximately 6 and 20 grams.

The day after that issue of Analog went on sale, Mr. Myles Salmon of Leavenworth, Kansas wrote to me. He referred me to the book *Strange But True* (Fawcett Publications, 1963).

With great pleasure and excitement I quote from his letter: "On p. 8, it reports that Dr. Duncan MacDougall, a Boston physician, weighed six people as they died. He used a cot bed on a standard platform-scale. Weight loss ranged between 3/8 and 1½ ounces. He also dispatched 15 dogs, with no weight loss noted. His experiment was conducted in 1906."

No error budget was provided in Mr. Salmon's letter, but his information is extremely encouraging. If Dr. MacDougall's results are confirmed by further careful experimentation, it will mean that:

a. The human soul actually exists and is an essential organ of the body.
b. The soul is pure energy.
c. Not all souls have precisely the same weight, but instead lie between the approximate limits (to

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single-place accuracy) of 10 and 40 grams (perhaps varying with knowledge or some other factors or factor).

d. If dogs have souls, each dog's soul would be at least an order of magnitude less in mass-equivalent than that of a human.

e. The ghost, the poltergeist, and the soul are probably all manifestations of the same entity.

It may seem astonishing that Dr. MacDougall's experiment was completed in 1906, yet has been ignored by the scientific, medical, and religious communities; but it makes sense if those communities had/have closed minds and were/are more interested in protecting their beliefs/private interests than in learning the truth. Very probably, others have also carried out this experiment, and have also had their results ignored. If any reader knows of such a case, please provide the *specific reference(s)* to me in care of Analog.

At this time, it is premature to claim that we have proven the existence of the soul. But we certainly have uncovered sufficient theoretical and experimental evidence to suggest that further experimentation is advisable. Such experimentation is, as of *now*, a *legitimate* area for scientific and medical researchers. If the various organized religions don't act soon, they may find that others have learned more about the true nature of the human soul than those same organized religions claim to know.

It will be fascinating to observe who has the guts to take the next step to confirm or refute Dr. MacDougall's results. And, if MacDougall's results are confirmed, even more fascinating to learn the true characteristics of the soul.

DR. DONALD G. CARPENTER

Calhan, CO

P.S. Could it be that our souls are the original "BODY SNATCHERS"?

Dear Stanley Schmidt:

After many years of reading, and quite a few of subscribing, I write with congratulations on your October '80 issue. No one story lingers the way "Dreamsnake" does; there's no serial like the original *Dune;* but the issue as a whole fulfills the promises, or gets a good start on trying to meet the needs, that I had just begun to wonder about having been neglected for some time by SF generally. In the words of Alexei Panshin from a few years back, that issue "scratched forgotten itches and satisfied unrecognized thirsts." No one quite knows what an editor does, but I hope you'll try to do whatever it was, often, again, and again.

TED JENNINGS

Loudonville, NY

I will.

Dear Dr. Schmidt,

I thoroughly enjoyed your editorial on crackpots and "crackpots" (October 1980). As a scientist and for many years a curator of vertebrate paleontology in a major natural history museum, I have met my share of both. There seems to be a lure about old dead animals that attracts crackpots and nuts. At one time I had a buzzer system connected to the lab so I could call for help and be rescued.

Despite the security systems that protect the "upstairs" of museums, a certain number of characters filter through. I once had a Time Traveler who had gone back to "the beginning." At that time the whole world was covered with water. Only the tip of Mt. Everest was exposed. He perched there and watched the water sink away until the world was exposed as it is today. All the time he

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was telling his tale he was holding a oversized cobble on his lap. This, he announced, was a rock that he had brought back from the top of Everest at "the beginning." I jumped up and said, "You should be talking to our geologist. Come and I'll introduce you." So I hauled him away and dumped him on my unsuspecting colleague.

Then there was the mining engineer who had had a revelation during an earthquake while riding a train to Mexico City. A large comet had come so close to the earth that it had nullified gravity. The seven outer layers of the earth rose into the sky. As the comet departed these layers fell back. Many of the fragments melted and became rounded as though in a shot tower. These are the rocks that geologists mistakenly believe to be rounded by stream or wave action. Some of these fell on plants and animals forming molds that we think of as fossils.

One man brought a manuscript modestly titled "The Extinction of the Dinosaurs and the Mammoths, the Greatest Contribution to Science Since the Atomic Bomb." For a small fee he would let us publish it in the museum bulletin. We had a mounted skeleton of a large and elderly mammoth on display. As the tusks grow throughout the life of elephants, this individual had tusks that overlapped. There was a picture of this mammoth in the manuscript with the explanation that this was a "breeding cage." When the bull mounted a cow he would drop the crossed tusks over her body to hold her in position! I think I set my desk on fire to get rid of that one.

We really get down to the fact that most scientists are busy people. They may be working at their hobbies with other people's money, but they are making contributions This leaves little time for crackpots. They haven't read the literature; they don't know the background; but they have discovered the TRUTH.

De Camp's article on the future of human evolution was great. I can hear myself saying the same things to many classes. The only difference being that I didn't say it as well. A point I would add is that when "doomsday" comes, be it a nuclear holocaust or a social upheaval (my vote), it will be the Third World people who will have the best long-range chance of survival.

J.R. MACDONALD

Rapid City, SD

Don't let anybody tell you life among the fossils is dull! Incidentally, did you notice the story potential in your last sentence?

Dear Mr. Schmidt,

Alchemy Books is planning to initiate a new science fiction/fantasy line. To kick this off, we would like to present an anthology of short stories by new and little-known authors. I would like to encourage anyone with a convincing, well-written story, which they genuinely feel deserves to see print. to dispatch it (with a S.A.S.E. for return) to Kenneth P. Cameron, Managing Editor, Alchemy Books, 681 Market St., Suite 755, San Francisco, CA 94105. Thank you very much.

KENNETH P. CAMERON

Correction:

Richard Crist illustrated the story "The Velvet Rose of Evening" in the November 1980 Analog. His name was spelled incorrectly on the opening page.

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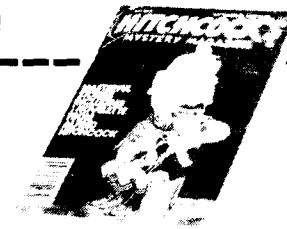

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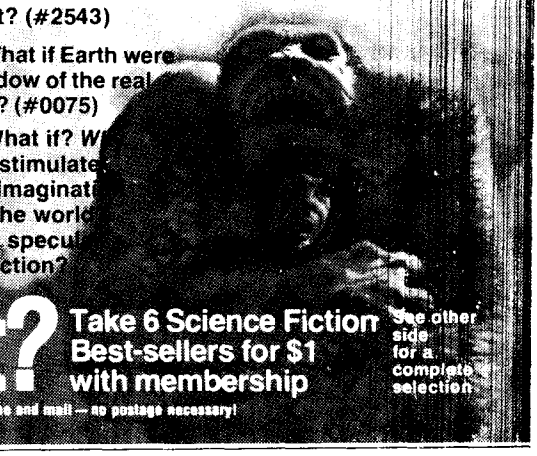

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